

# 2010 Furbearer Program Annual Report

MISSOURI DEPARTMENT OF CONSERVATION



Resource Science Division

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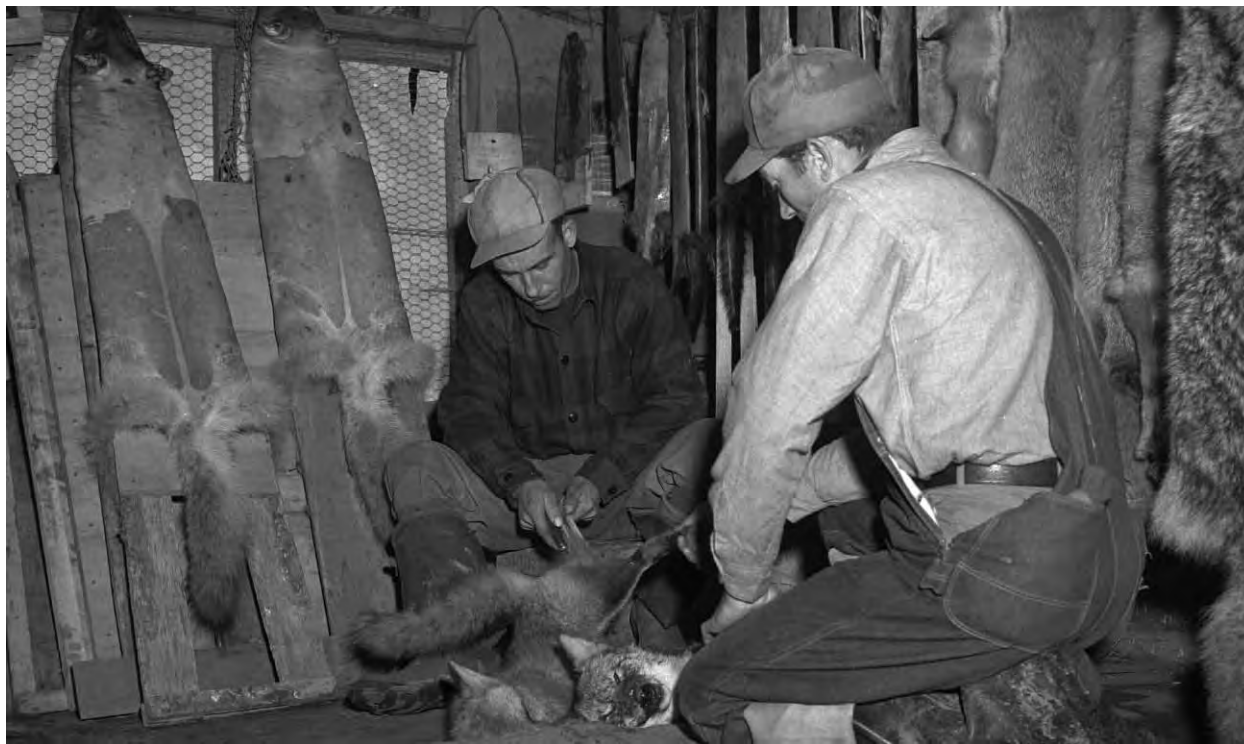
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## INTRODUCTION

**Missouri's wild fur market** has been monitored annually since 1940, with some information dating back to 1934. Over time, we have witnessed tremendous fluctuations in the harvests of Missouri's primary furbearing animals as both market and social trends change. We monitor the fur market using mandatory fur dealer and fur handler transaction records, interviews with fur dealers, mandatory pelt registration of bobcats (since 1980) and river otters (since 1996), and information gathered at fur auctions.

The number of Fur Dealer Permits issued by the Missouri Department of Conservation (Department) peaked at 1,192 during the 1945-46 season. In 2009, the Department sold 37 Resident and four Non-Resident Fur Dealer Permits. The number of Resident Trapping Permits sold peaked at 13,248 in 1980-81 (permits were first required in 1953), and reached a low of 2,050 in 2000. During the 2009-10 trapping season, the Department sold 4,493 Resident and 151 Non-Resident Trapping Permits (Table 1). The number of Cable Restraint Permits sold was 535.



Fur trappers examine pelts near Orrick, Missouri, in 1947.

Total pelts harvested reached 834,935 in 1940-41 (over 70% were opossum and skunk pelts), and reached the second highest peak in 1979 at 634,338 when average raccoon pelt values were estimated at \$27.50. The overall value of the furbearer harvest also peaked in 1979-80 at over \$9 million. Pelt values declined dramatically during the late 1980s and through the mid 1990s, as a result the number of participants fell to all-time lows. Current market trends suggest that we may be witnessing another lengthy period of relatively low pelt values for many of the commonly hunted and trapped species.

In addition to harvest information, wildlife population trends are monitored using archer's indices and sign station surveys. Archer's indices are based on annual wildlife observation reports sent in by cooperating bowhunters. Sign station surveys are run each September by Department staff in 25 counties. A more detailed account of sign station surveys and archer's indices can be found in Section 2.

Also contained in Section 2 are updates and progress summaries for various furbearer-related research projects, monitoring efforts, or items of interest. These are only for informational purposes and should be considered draft reports. For more information on any of these draft reports please contact Jeff Beringer at (573) 882-9909 ext. 3211 or [Jeff.Beringer@mdc.mo.gov](mailto:Jeff.Beringer@mdc.mo.gov).

Regulation changes for the 2010-11 furbearer trapping season include:

- Season length for cable restraint devices has been expanded from December 15 through the last day in February.
- The Cable Restraint Device Permit has been eliminated. The only permit now required is a Resident Trapping Permit, but the trapper is still required to complete a certified training course. When a trapper is cable restraint certified it will be indicated on the trapping permit.
- Otter trapping zones have been eliminated. The new statewide season runs from November 15 – February 20 with no limit.
- The deadline for CITES tagging of bobcat and otter pelts has been extended to April 10.

## SECTION 1:

### Missouri Furbearer Status 2009-2010

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## FUR HARVEST COMPARISONS

To buy and sell fur in Missouri, fur dealers must purchase a commercial Fur Dealer Permit from the Department. The permit requires fur dealers to record and submit records of all fur transactions. Since 2005, Fur Handler Permits have been available to trappers to extend the normal possession date, giving them more flexibility in selling and shipping furs to auction houses. As a condition of the permit, fur handlers must submit by June 10 the number of pelts held. Together, the data collected from both fur dealers and fur handlers give an estimate of furbearer harvest (Table 1). In addition, harvest numbers for bobcats and otters are gathered from mandatory pelt registration required by the Convention on International Trade of Endangered Species (CITES).

Table 1. Furbearer harvest and pelt prices in Missouri over the last three years.

Species	FUR SEASON					
	2009-10		2008-09		2007-08	
	Number of pelts sold or registered*	Pelt Prices from MTA Auctions	Number of pelts sold or registered	Pelt Prices from MTA Auctions	Number of pelts sold or registered	Pelt Prices from MTA Auctions
Raccoon	47,919	\$12.20	109,085	\$9.77	118,166	\$17.95
Opossum	4,491	\$2.22	9,600	\$1.98	11,135	\$1.91
Muskrat	9,877	\$6.91	9,308	\$3.08	8,125	\$3.29
Coyote	1,520	\$10.95	2,506	\$8.75	3,449	\$13.34
Beaver	3,535	\$13.75	6,081	\$11.84	6,107	\$15.17
Mink	614	\$10.67 (m) \$5.41 (f)	702	\$7.87 (m) \$6.25 (f)	1,072	\$10.59 (m) \$6.75 (f)
Red Fox	479	\$14.82	1,004	\$13.30	1,236	\$15.46
Gray Fox	325	\$15.08	703	\$17.85	1,205	\$34.88
Striped Skunk	212	\$2.75	614	\$3.73	616	\$3.61
Badger	23	\$3.50 (1 sold)	39	\$17.50 (1 sold)	47	\$13.17
Bobcat	2,131	\$36.30	3,333	\$23.68	3,747	\$56.93
River Otter	1,159	\$37.84	1,488	\$26.91	1,454	\$32.00
Trapping permits sold (resident)	4,437		6,439		5,126	

\* Pelts sold (except bobcat and otter where harvest is based on CITES registration) is based on reports received from the 41 Fur Buyer Permittees and 66 out of 323 Fur Handler Permittees.



## MISSOURI FUR AUCTION PRICES

Fur auctions are held by the Missouri Trappers Association (MTA) two to three times yearly at the Boone County Fairgrounds. Prices are averaged from all fur sold, including green, finished and damaged (Table 2).

Over the last 10 years, fur auction prices have shown tremendous fluctuation. The 2009-10 average prices were above the 10-year and 2008-09 season averages for most species (Table 3).



Table 2. Range of furbearer pelt prices in Missouri during the 2009-10 hunting/trapping season.

Species	Total Number of Pelts Sold	2010 Auction Prices		Average Prices for 2010	Change in Price from Last season
		January 22	February 6		
Raccoon	7,799	\$12.93	\$11.47	\$12.20	+24.9%
Opossum	1,038	\$2.42	\$2.01	\$2.22	+12.1%
Muskrat	1,811	\$7.71	\$6.11	\$6.91	+124.4%
Coyote	149	\$11.71	\$10.19	\$10.95	+25.1%
Beaver	609	\$13.45	\$14.06	\$13.75	+16.1%
Mink – Male	62	\$11.50	\$9.84	\$10.67	+35.6%
Mink – Female	28	\$4.33	\$6.48	\$5.41	-30.7%
Red Fox	66	\$14.66	\$14.97	\$14.82	+11.4%
Gray Fox	59	\$15.12	\$15.03	\$15.08	-15.5%
Striped Skunk	60	\$3.00	\$2.50	\$2.75	-26.3%
Badger	1	\$3.50	--	\$3.50	-80.0%
Bobcat	90	\$36.24	\$36.36	\$36.30	+53.3%
Otter	173	\$37.80	\$37.88	\$37.84	+40.6%

Table 3. Comparison of average furbearer auction prices over the last ten trapping seasons.

Species	Average Price per Season										10 Year Average
	2009-10	2008-09	2007-08	2006-07	2005-06	2004-05	2003-04	2002-03	2001-02	2000-01	
Raccoon	\$12.20	\$9.77	\$17.95	\$11.90	\$8.23	\$5.60	\$9.15	\$6.38	\$8.51	\$7.65	\$9.73
Opossum	\$2.22	\$1.98	\$1.91	\$1.65	\$1.56	\$1.30	\$1.40	\$1.11	\$1.31	\$1.15	\$1.34
Muskrat	\$6.91	\$3.08	\$3.29	\$5.72	\$4.39	\$1.10	\$1.40	\$1.51	\$2.25	\$1.69	\$2.76
Coyote	\$10.95	\$8.75	\$13.34	\$17.84	\$12.04	\$8.80	\$14.95	\$11.86	\$4.50	\$6.18	\$9.16
Beaver	\$13.75	\$11.84	\$15.17	\$18.10	\$13.70	\$8.30	\$9.90	\$5.20	\$9.21	\$10.15	\$11.25
Mink (male)	\$10.67	\$7.87	\$10.59	\$15.84	\$16.12	\$7.85	\$8.30	\$6.60	\$6.47	\$8.03	\$9.96
Red Fox	\$14.82	\$13.30	\$15.46	\$18.88	\$15.54	\$12.60	\$17.85	\$18.35	\$17.02	\$13.27	\$14.40
Gray Fox	\$15.08	\$17.85	\$34.88	\$32.86	\$16.23	\$9.65	\$14.20	\$8.61	\$5.47	\$6.12	\$13.04
Str. Skunk	\$2.75	\$3.73	\$3.61	\$5.47	\$2.96	\$1.80	\$3.75	\$4.71	\$4.00	\$1.85	\$2.92
Badger	\$3.50	\$17.50	\$13.17	\$26.00	\$15.23	\$6.60	\$6.50	\$4.50	\$4.65	\$4.25	\$7.95
Bobcat	\$36.30	\$23.68	\$56.93	\$59.78	\$44.53	\$28.50	\$50.15	\$25.38	\$20.40	\$22.87	\$30.41
Otter	\$37.84	\$26.91	\$32.00	\$42.77	\$124.92	\$89.25	\$112.45	\$76.97	\$56.70	\$52.37	\$56.18



## RACCOON POPULATION AND HARVEST TRENDS

Estimates of raccoon hunters (via Small Game Harvest Mail Survey) peaked in the 1979-80 season at 48,000 participants. Since then numbers have declined and appear to have leveled at around 12,000 hunters annually.

Raccoon harvest, including trapping, for the 2009-10 season was 47,919, down 56 percent from the 2008-09 season and down 59 percent from the 2007-08 season (Figure 1). Several factors contributed to this decline including 1) a surplus of finished raccoon pelts from the previous year, 2) uncertainty and economic difficulties in Greece and Russia both of which are primary outlets for Missouri fur, and 3) a short catch due to fewer trappers and poor weather conditions.

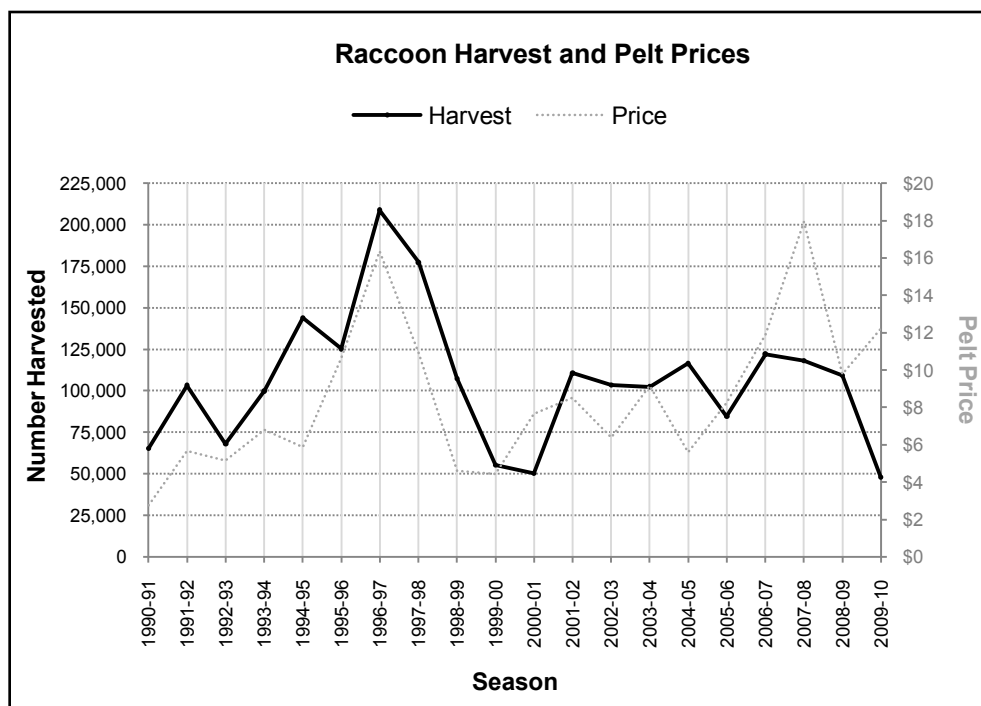


Figure 1. Comparison of raccoon harvest and pelt prices over the last 20 years.

Raccoon observations from bowhunters during 2009 rose slightly from 2008 levels (Figure 2). Despite a spike in 2006, the overall trend in sightings appears to be steady with a slight increase over the last decade.

The presence of raccoon tracks at furbearer sign stations reached its highest number in 2007 but dropped in 2008 to the lowest index since 2001 (Figure 3). More rain than average in September may have affected the 2008 survey. We did experience significant distemper mortality in localized areas and

this may have also contributed to lower indices in some areas. In 2009, the index rebounded to its highest level yet. Overall, the number of raccoon visits per 1,000 operable stations has nearly tripled in the last 30 years as this adaptable generalist continues to thrive.

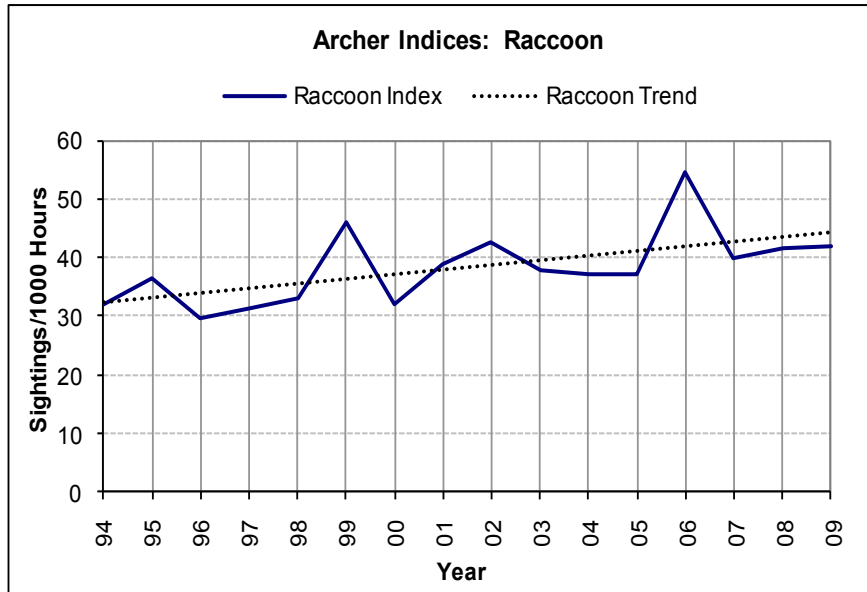


Figure 2. Raccoon population trends based on the bowhunter observation survey.

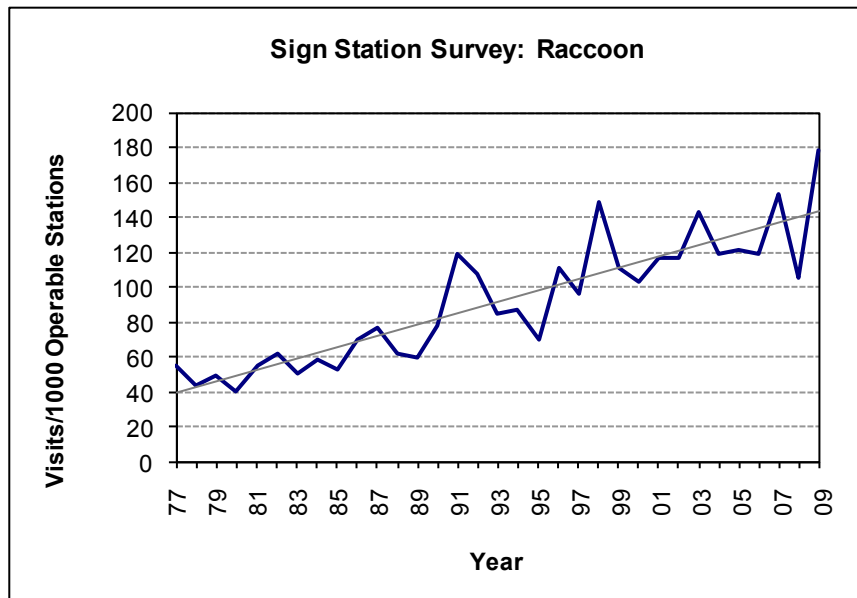


Figure 3. Raccoon population trends based on sign station surveys.



## COYOTE POPULATION AND HARVEST TRENDS

Coyote fur harvest during the 2009-10 season (1,520) was the lowest in eight years, dropping 39 percent from the 2008-09 season (Figure 4). Coyote pelt values, averaging \$10.95 during the 2009-10 season, were too low to attract most trappers. However, many trappers are using cable restraints to capture coyotes for the live market associated with hound running pens. This harvest is not reflected in the data. Trend data for coyotes suggest (Figures 5 and 6) populations are stable but higher than those observed during the mid 1970s. Mange in both coyotes and red fox has been reported each year but major outbreaks have not materialized.

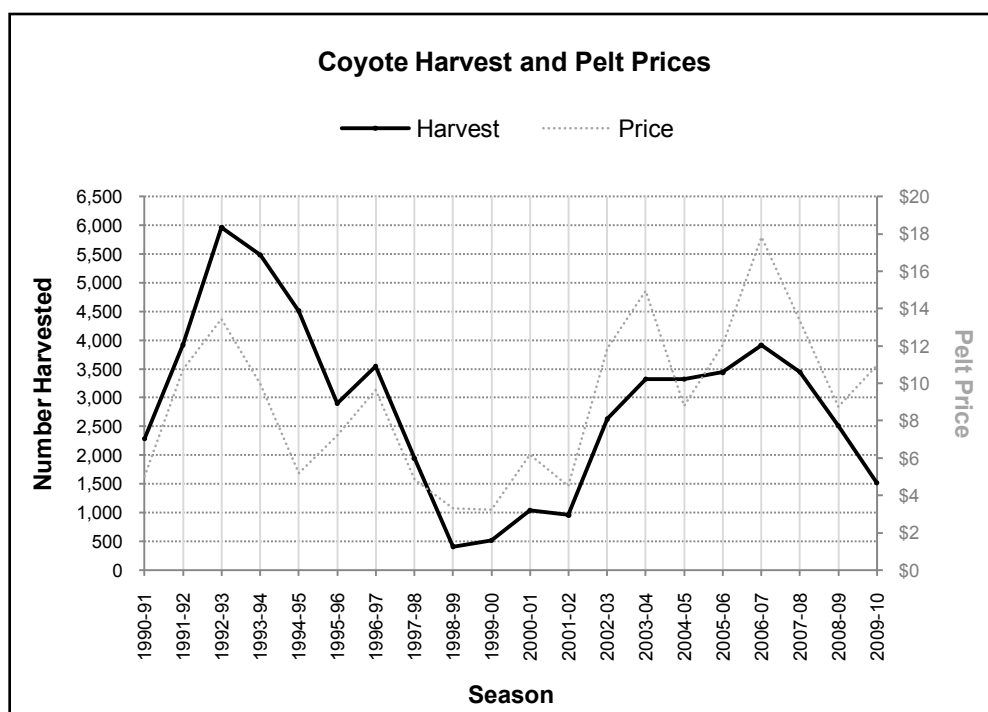


Figure 4. Comparison of coyote harvest and pelt prices over the last 20 years.

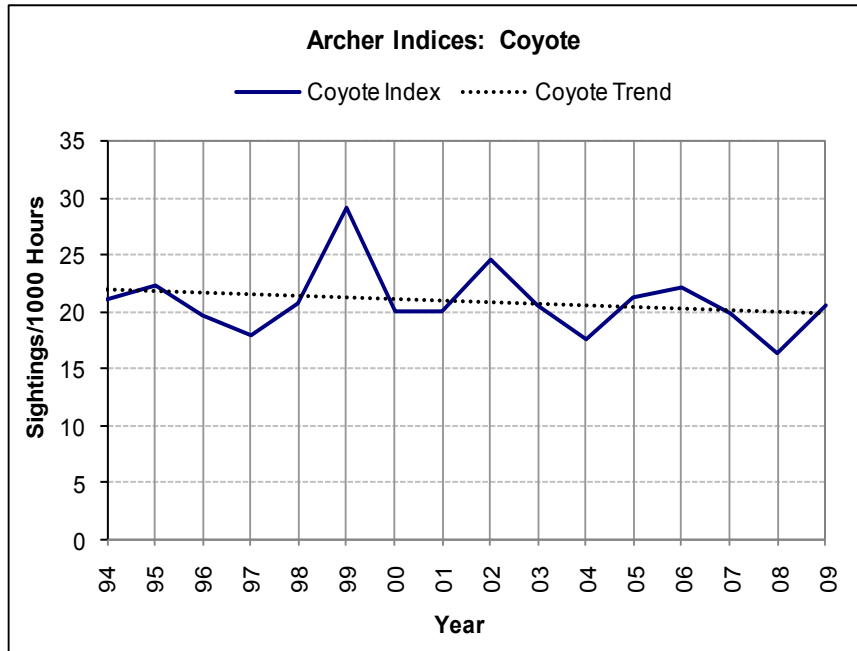


Figure 5. Coyote population trends based on the bowhunter observation survey.

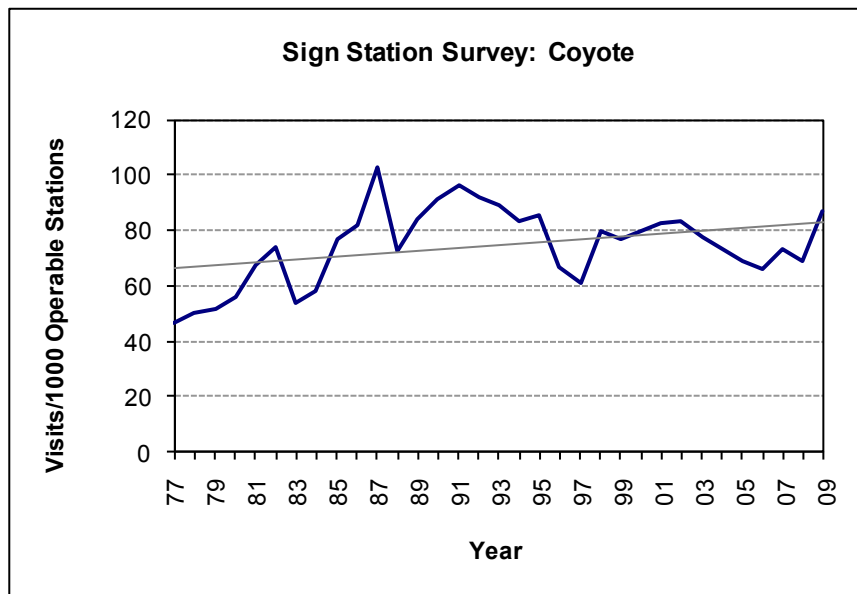


Figure 6. Coyote population trends based on sign station surveys.



## FOX POPULATION AND HARVEST TRENDS

During the 2009-10 season, red fox harvest (1,004) dropped 19 percent and gray fox harvest (703) dropped 42 percent when compared to the previous season (Figures 7 and 8). Both the archer observations and sign station surveys reflect an observed dip in both red and gray fox populations (Figures 9 and 10). We have received more reports of red fox with mange and gray fox with distemper these past few years and trappers are reporting lower gray fox numbers especially in eastern Missouri.

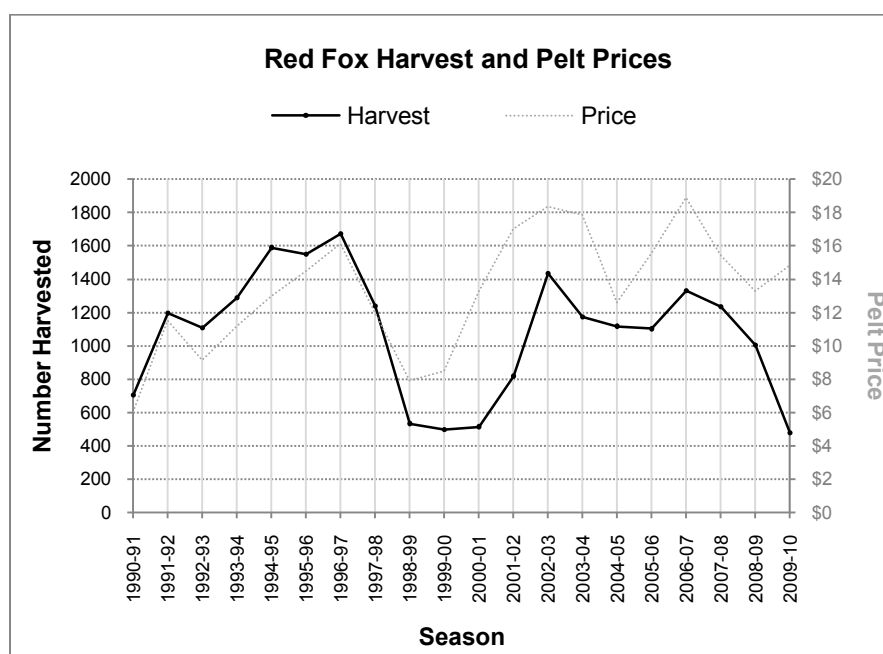


Figure 7. Comparison of red fox harvest and pelt prices over the last 20 years.

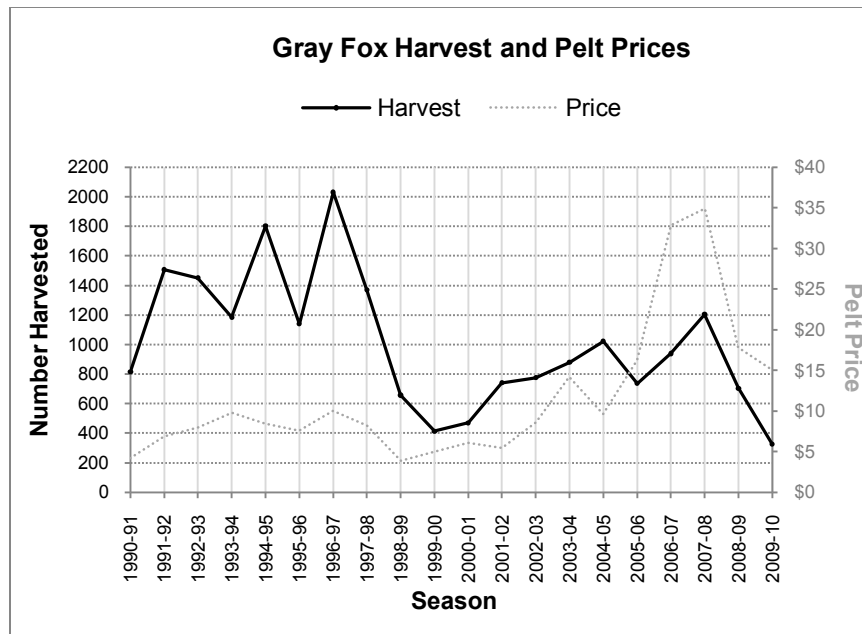


Figure 8. Comparison of gray fox harvest and pelt prices over the last 20 years.

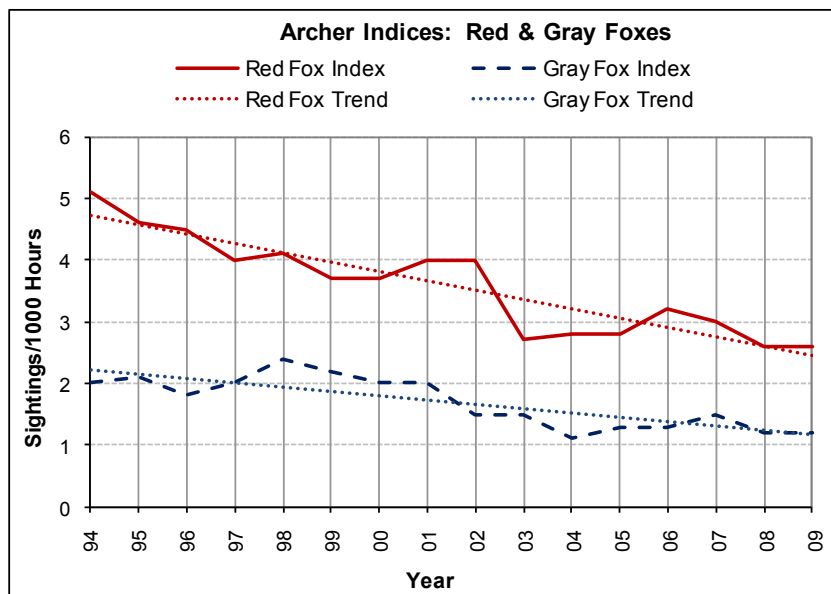


Figure 9. Fox population trends based on the bowhunter observation survey.

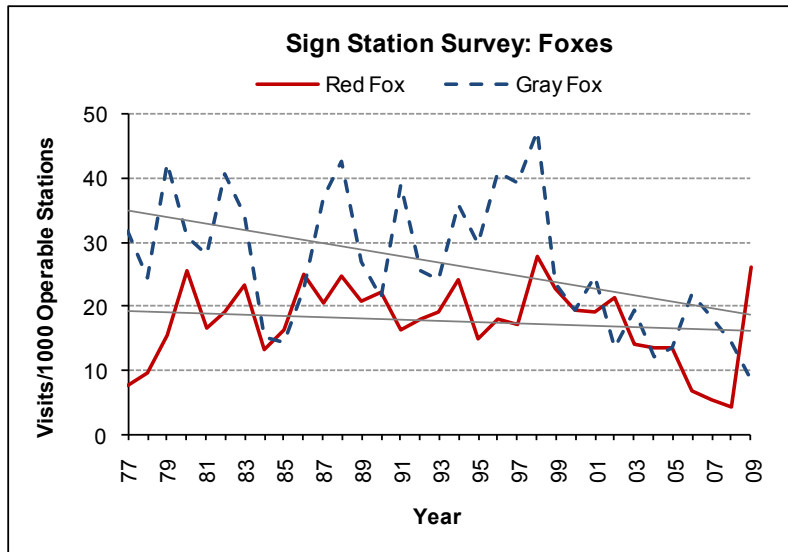


Figure 10. Fox population trends based on sign station surveys.



## BOBCAT POPULATION AND HARVEST TRENDS

Trappers and hunters are required to check and seal bobcat carcasses or green pelts at Department offices or with Conservation Agents. The data collected are used to monitor bobcat harvest in Missouri and to comply with CITES regulations.

The statewide harvest for bobcats during the 2009-10 season was 2,128, down 36 percent from the 2008-09 harvest of 3,333 and down 43 percent from the 2007-08 harvest of 3,747 bobcats (Figure 11). Bobcat harvest peaked during the 2006-07 season (4,453) when bobcat pelt prices averaged nearly 60 dollars (Figure 12). Comparatively, average pelt price in 2008-09 was just over 36 dollars.

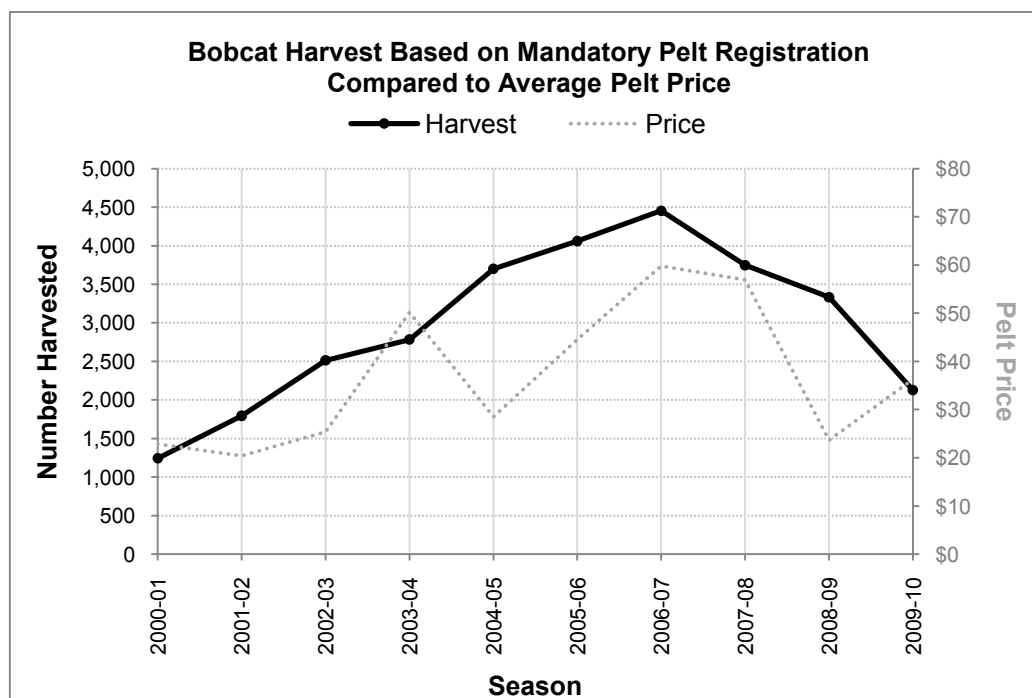


Figure 11. Bobcat harvest trends over the last 10 years compared to average pelt prices.

The number of bobcat pelts purchased by fur dealers (682) was significantly less than the number of bobcats checked by trappers as required by CITES (2,128). Instead of selling to fur buyers, trappers can make more money by selling carcasses to taxidermists or selling mounted bobcats on the internet. The significant drop in pelt sales to fur dealers is likely a reflection of this trend.

Archer and sign station trend data suggest bobcat populations may have dipped some over the last couple years, but the overall trend is still stable to increasing (Figures 12 and 13). Regional harvest (Table 4, Figure 14) of bobcats has dropped in most of Missouri, likely the result of lower pelt values and poor trapping conditions during December and January when most trappers target bobcats.

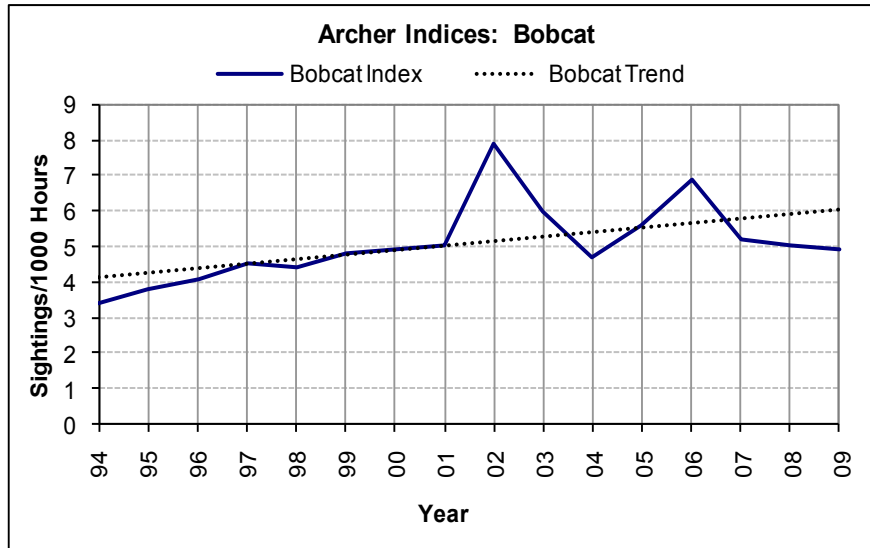


Figure 12. Bobcat population trends based on the bowhunter observation survey.

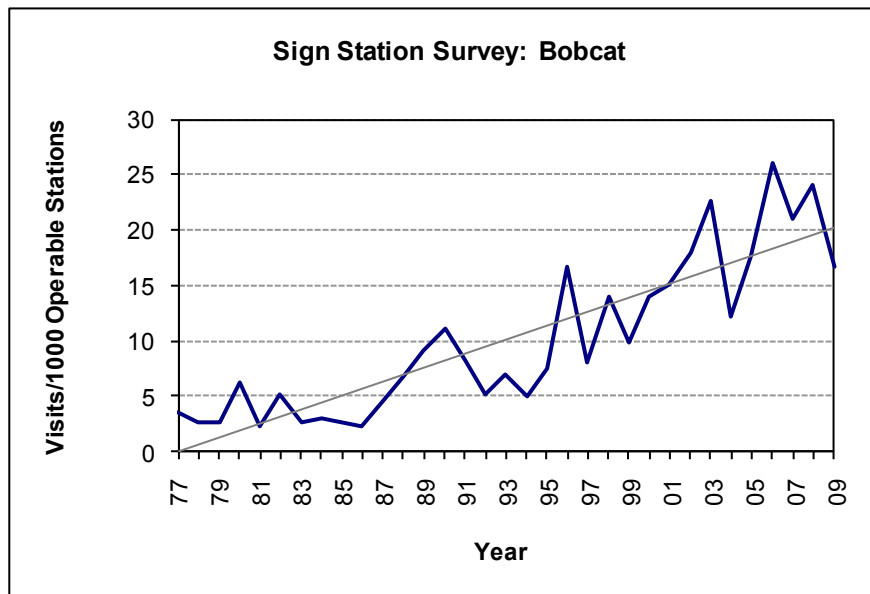


Figure 13. Bobcat population trends based on sign station surveys.

Table 4. Bobcat harvest (based on mandatory pelt registration) and pelt prices from 2000 – 2009, in Missouri, by Zoogeographic Regions.

<b>ZooRegion</b>	<b>Bobcats Harvested per Season</b>									
	<b>00-01</b>	<b>01-02</b>	<b>02-03</b>	<b>03-04</b>	<b>04-05</b>	<b>05-06</b>	<b>06-07</b>	<b>07-08</b>	<b>08-09</b>	<b>09-10</b>
Northwest Prairie	84	194	470	347	410	470	493	358	341	150
Northern Riverbreaks	96	166	294	387	552	604	636	373	404	192
Northeast Riverbreaks	44	92	126	150	446	558	678	521	492	379
Western Prairie	288	355	497	605	624	616	763	572	446	235
Western Ozark Border	154	212	298	297	364	473	431	377	312	223
Ozark Plateau	349	492	487	648	881	852	918	984	868	550
North and East Ozark Border	120	178	205	233	291	289	372	316	307	243
Mississippi Lowlands	99	98	113	116	133	208	158	159	157	154
Unknown	9	7	0	0	0	1	4	46	6	2
<b>TOTAL</b>	<b>1,243</b>	<b>1,794</b>	<b>2,513</b>	<b>2,783</b>	<b>3,701</b>	<b>4,061</b>	<b>4,453</b>	<b>3,706</b>	<b>3,333</b>	<b>2,128</b>
Bobcat Pelt Prices	\$22.87	\$20.40	\$25.38	\$50.15	\$28.50	\$44.53	\$59.78	\$56.93	\$23.68	\$36.30

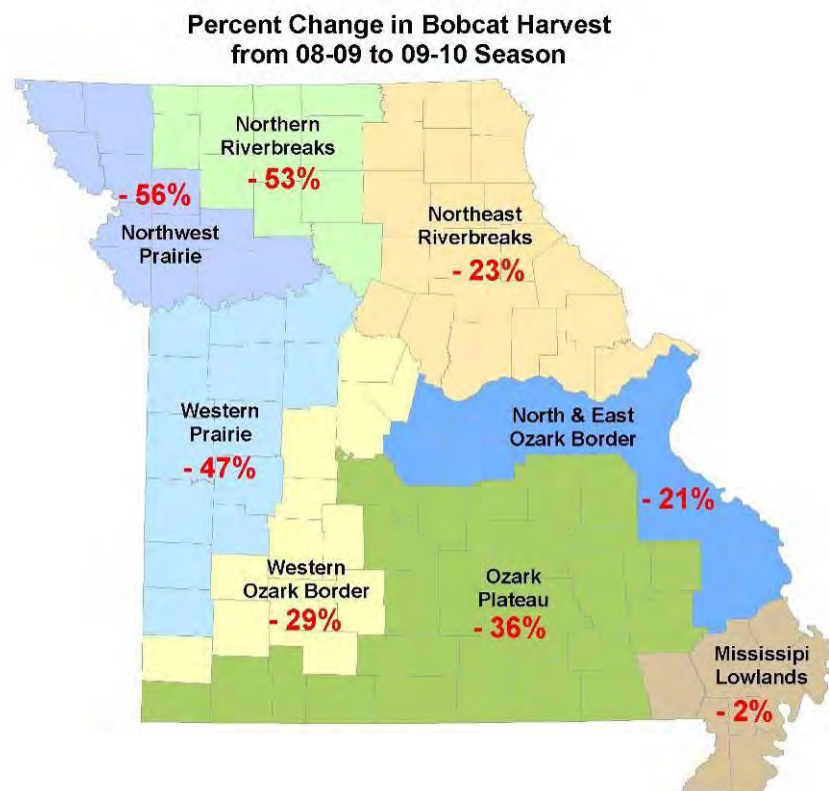
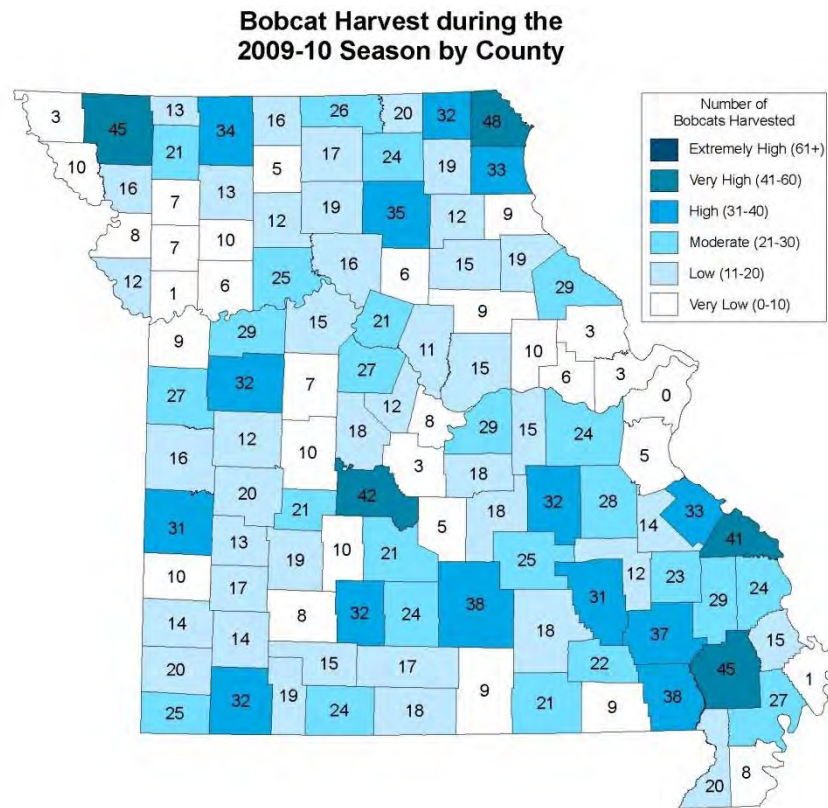


Figure 14. Maps showing comparison of bobcat harvest between counties and harvest seasons.

Bobcat harvest distribution (Table 5) suggests high hunting harvest occurs earlier in the season, mostly from firearms deer hunters and trapping harvest is after December when pelts are most prime.

Table 5. Bobcat and otter harvest during each week of the 2009-10 season

<b>Week of Season</b>	<b>Dates</b>	<b>Number of Bobcats Harvested</b>	<b>Number of Otters Harvested</b>
---	Before Nov. 15	8	2
1	Nov. 15 – 21	283	77
2	Nov. 22 – 28	200	110
3	Nov. 29 – Dec. 5	225	140
4	Dec. 6 – 12	160	111
5	Dec. 13 – 19	173	122
6	Dec. 20 – 26	219	118
7	Dec. 27 – Jan. 2	222	73
8	Jan. 3 – 9	159	62
9	Jan. 10 – 16	186	67
10	Jan. 17 – 23	130	82
11	Jan. 24 – 30	103	70
12	Jan. 31 – Feb. 6	17	23
13	Feb 7 – 13	4	35
14	Feb. 14 – 20	1	23
---	After Feb 20	0	1
---	Unknown date	41	43
<b>TOTAL</b>		<b>2,131</b>	<b>1,159</b>



## OTTER POPULATION AND HARVEST TRENDS

Trappers and hunters are required to check and seal river otter carcasses or green hides at Department offices or with Conservation Agents. The data collected are used to monitor statewide and regional otter harvest in Missouri and to comply with CITES regulations.

Based on otter check sheets, the 2009-10 statewide harvest was 1,159, about 22 percent lower than last year and 20 percent lower than the 2007-08 season (Table 6). Otter pelt prices, and not abundance, likely influenced the harvest rates. For a comparison of harvest and pelt prices see Figure 15.

Table 6. Missouri river otter harvest by trapping zone, based on mandatory pelt registration.

ZONE	HARVEST SEASON						
	2003-2004	2004-2005	2005-2006	2006-2007	2007-08	2008-09	2009-10
A	77	93	105	55	36	57	27
B	1450	1622	1862	1060	794	677	524
C	41	40	41	56	36	26	35
D	14	5	9	23	7	12	16
E	1174	1214	1252	731	477	606	465
Unknown	2	7	5	4	71	110	92
<b>TOTAL</b>	2,758	2,981	3,274	1,929	1,421	1,488	1,159

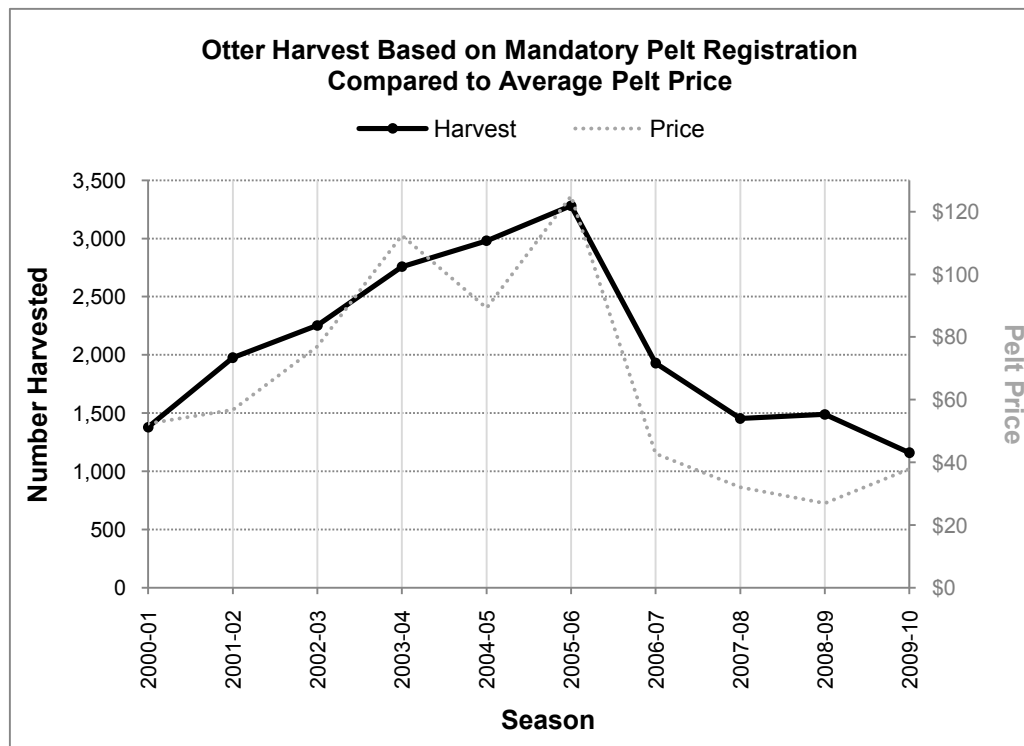


Figure 15. Comparison of otter harvest trends and average auction pelt prices over the last 10 years.

Most river otter harvest occurs in Zones B and E (Figure 16). High otter pelt prices have resulted in lower otter densities on some Ozark streams and this likely has eased tension by local fisherman toward otters. Recent low pelt prices may allow otter populations to rebound and the Department should expect more complaints by fisherman and pond owners.

Beginning with the 2010-11 season, the Department will have no quota on otter harvest (similar to all other harvestable furbearing species) and harvest zones have been eliminated. The goal for the change was to simplify regulations and encourage legal harvest to maintain otter densities that are compatible with Ozark fisheries. Although most otter harvest occurs during December and January (see Table 5 on page 17), a longer season does facilitate targeted harvests. The Department is currently studying metabolic rates and census techniques to gain a better understanding of how otters may impact fish populations in Ozark streams.

## Otter Harvest per Trapping Zone 2009-10 Season

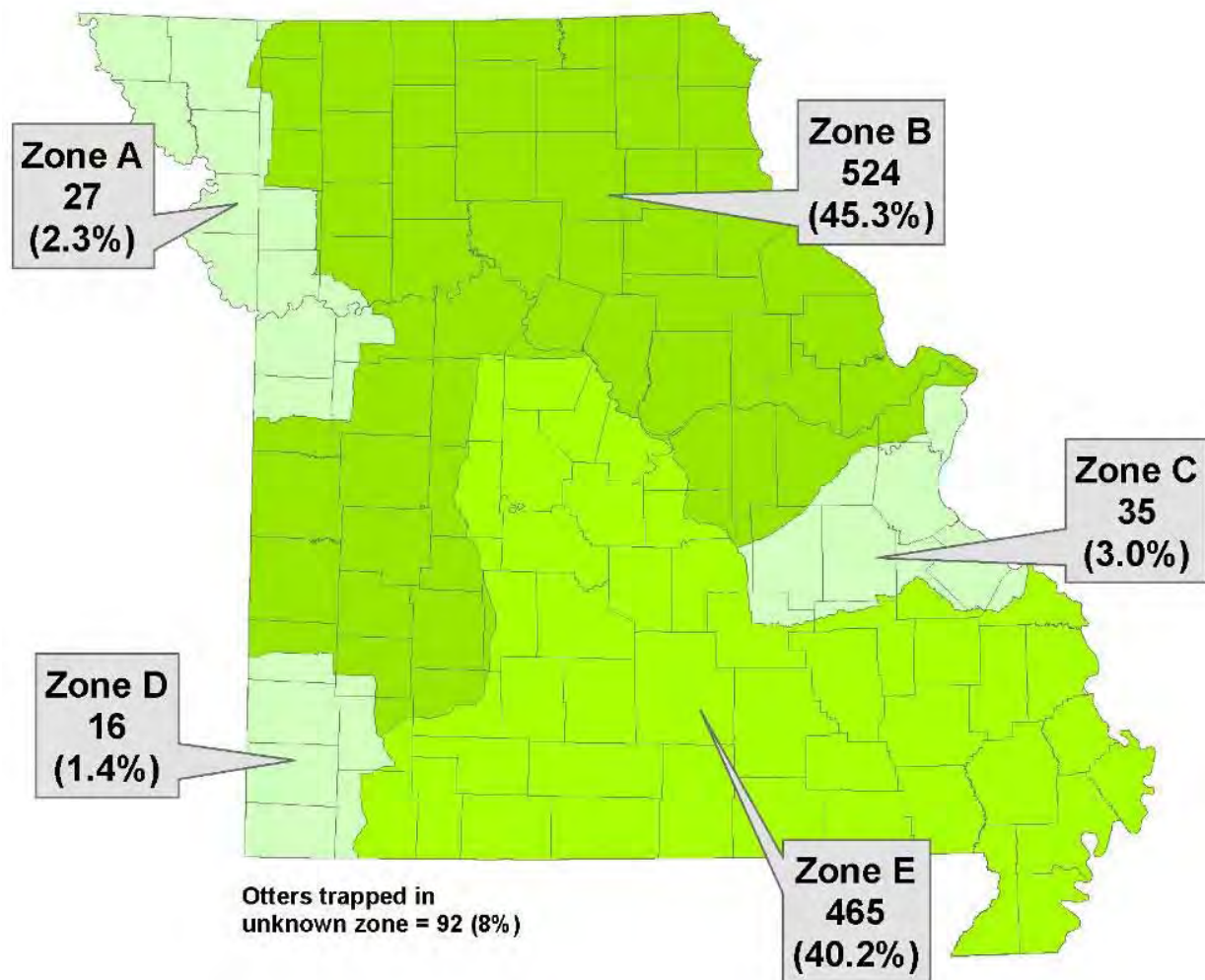


Figure 16. Percent of otter harvest taken in each of the five trapping zones.

Figure 17. The number of otters harvested by county during the 2009-10 season.

Of Missouri's watersheds, otter harvest during the 2009-10 season was highest (category "76 or more harvested") in the Missouri River watershed (Figure 18, Table 7), which accounted for ten percent (121) of the harvest. Other watersheds with "very high" harvest (class "51 to 75") included the Gasconade, St. Francis, Osage River West, and Grand River watersheds.

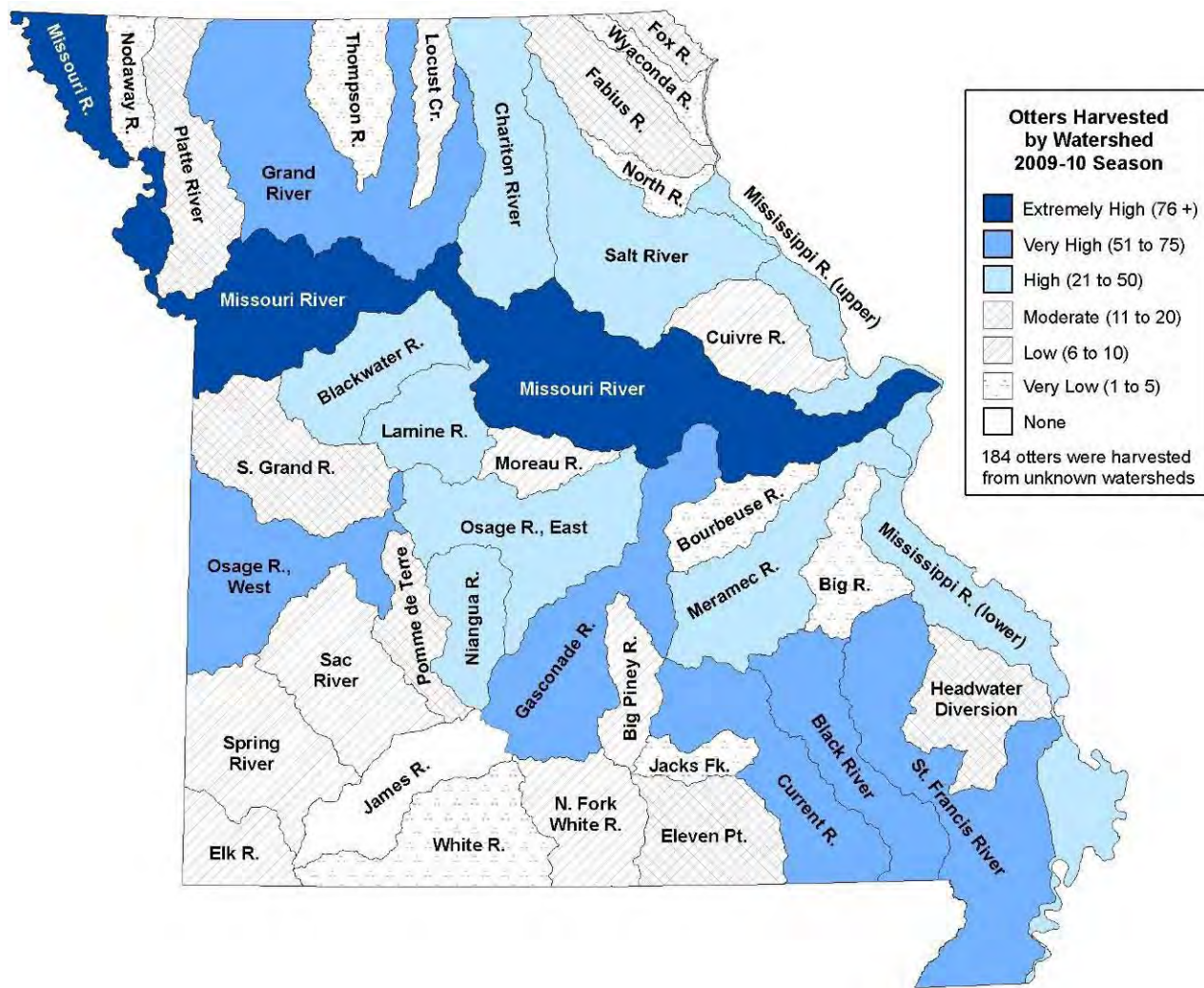


Figure 18. Otter harvest distribution among watersheds during the 2009-10 season.

Table 7. Otter harvest distribution among watersheds during the 2009-10 trapping season.

Watershed	Number Harvested	Percent of Harvest
Big Piney River	9	0.78%
Big River	1	0.09%
Black River	58	5.01%
Blackwater River	25	2.16%
Bourbeuse River	5	0.43%
Chariton River	42	3.63%
Cuivre River	9	0.78%
Current River	66	5.70%
Eleven Point River	19	1.64%
Elk River	10	0.86%
Fabius River	12	1.04%
Fox River	11	0.95%
Gasconade River	72	6.22%
Grand River	53	4.58%
Headwater Diversion	20	1.73%
Jacks Fork River	4	0.35%
James River	0	0.00%
Lamine River	24	2.07%
Locust Creek	6	0.52%
Meramec River	32	2.76%
Mississippi R. (lower)	33	2.85%

Watershed	Number Harvested	Percent of Harvest
Mississippi R. (upper)	43	3.71%
Missouri River	122	10.54%
Moreau River	9	0.78%
N. Fork White River	10	0.86%
Niangua River	31	2.68%
Nodaway River	5	0.43%
North River	3	0.26%
Osage River East	23	1.99%
Osage River West	57	4.92%
Platte River	14	1.21%
Pomme de Terre River	13	1.12%
S. Grand River	11	0.95%
Sac River	9	0.78%
Salt River	39	3.37%
Spring River	8	0.69%
St. Francis River	58	5.01%
Thompson River	3	0.26%
White River	2	0.17%
Wyaconda River	4	0.35%
Unknown	184	15.89%
TOTAL HARVEST	1,158	100%

## SECTION 2:

### Research Projects and Other Issues

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## FURBEARER SIGN STATION SURVEY

### SUMMARY OF 2009 FURBEARER SIGN STATION SURVEY

Liz Forbes, Resource Assistant, Missouri Department of Conservation

#### Background

The Furbearer Sign Station Survey occurs annually around mid-September. The survey dates back to 1977 and gathers furbearer population trend information across the state. Currently there are twenty-five routes, each in a different county. Each route is broken into five segments with 10 sign stations each, for a total of 50 sign stations per route. Sign stations are 36-inch diameter circles of sifted soil, set up every 0.3 miles along shoulders of gravel roads. In the middle of each station is a cotton swab doused with a fatty acid scent attractant. Stations are set up in a day and checked the next day for presence of animal tracks.



When checking the stations, observers note whether or not stations are operable. If a station has been destroyed by a road grader or other vehicle, the station is deemed inoperable and not included in index calculations. If a station is operable, it is included in the calculation of indices regardless of the presence of tracks. Observers identify any tracks within the station but do not count the number of animals of any species visiting a station.

#### Results

In 2009, eighteen of 25 routes (Figure 1) were completed with a total of 838 operable stations out of a possible 900. A breakdown of operable stations per Zooregion is shown in Table 1. Inoperable stations were due to tire tracks, mowers, and road graders.

Table 1. Summary of operable and inoperable sign stations in 2009 by Zooregion.

Zooregion	Number of routes completed	Number of operable stations	Number of inoperable stations
Northwest Prairie	2	94	6
Northern Riverbreaks	3	147	3
Northeast Riverbreaks	2	92	8
Western Prairie	2	96	4
Western Ozark Border	1	47	3
Ozark Plateau	4	178	22
North & East Ozark Border	3	138	12
Mississippi Lowlands	1	46	4
<b>TOTAL</b>	<b>18</b>	<b>838</b>	<b>62</b>

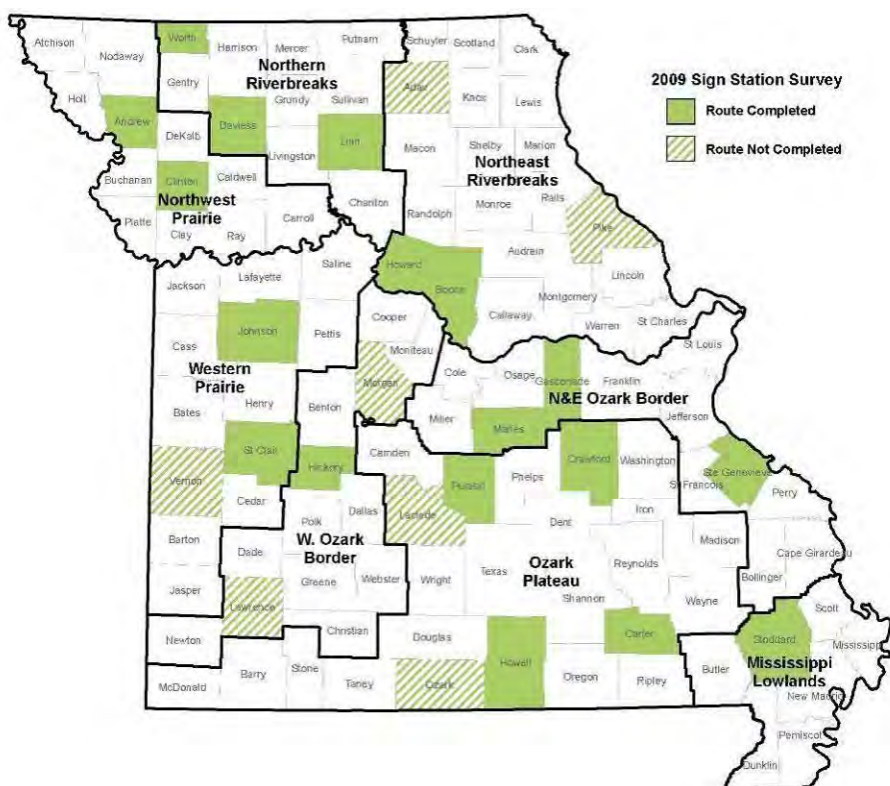


Figure 1. Map of Missouri showing counties with sign station routes within their respective Zooregion and the location of routes completed in 2009.

The most common furbearer species to visit sign stations include raccoon, opossum, and coyote (Figures 2 and 3). Less common visitors include skunk, bobcat, red fox, and gray fox. Birds such as sparrows, turkeys, and quail are also attracted to the freshly sifted soil of the sign stations.

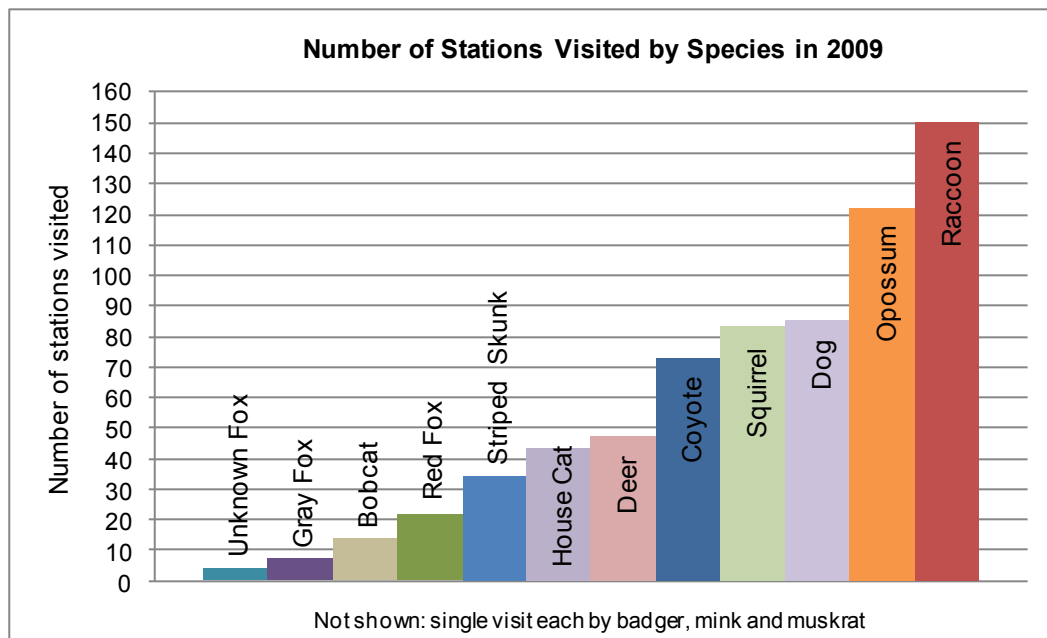


Figure 2. The number of stations visited by mammal species (including non-furbearers) out of 838 operable stations in the 2009 survey.

Figures 3 through 6 show furbearer population trends based on the Furbearer Sign Station Survey, 1977-2009. Overall, trends indicate that most furbearer species have steady to slightly increasing populations. A slight downward trend is indicated for red and gray fox populations, which is also reflected in bowhunter observations and harvest records.

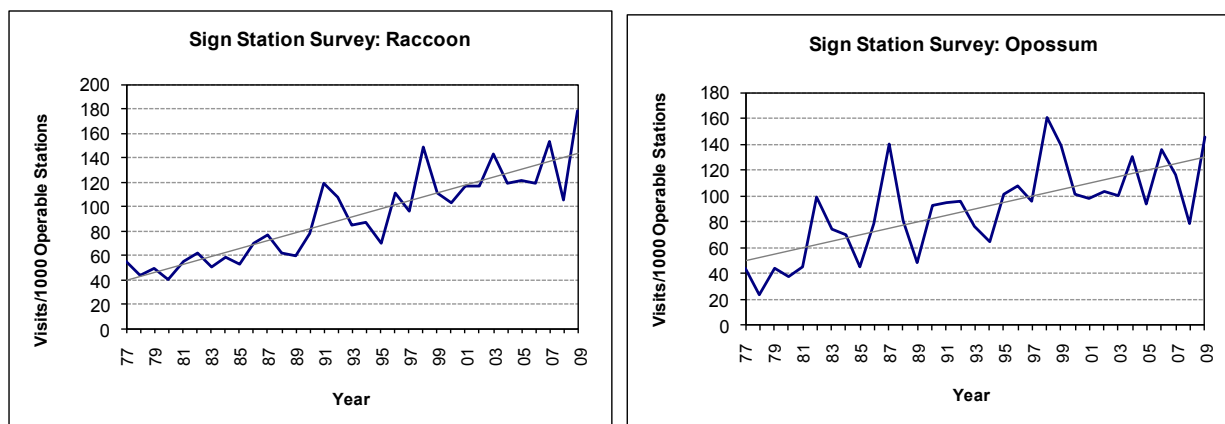


Figure 3. Raccoon and opossum population trends based on annual Furbearer Sign Station Survey.

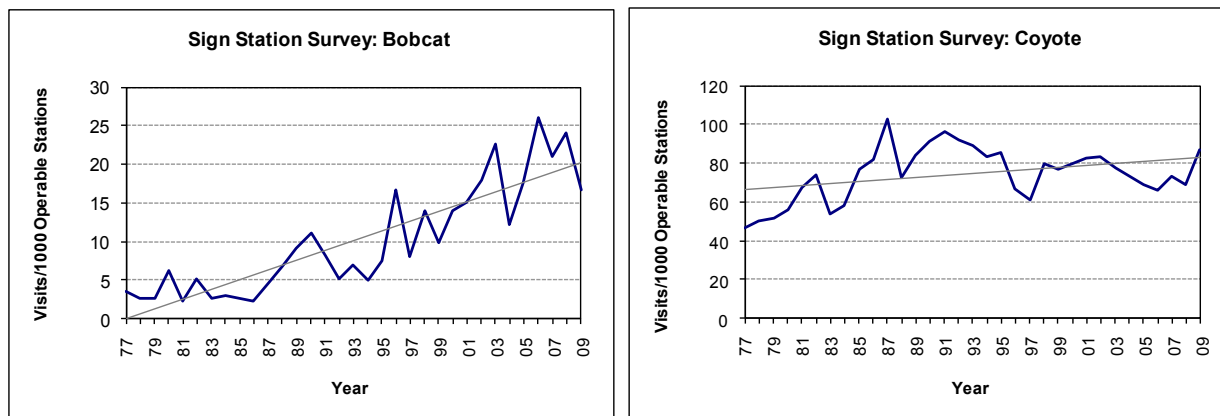


Figure 4. Bobcat and coyote population trends based on annual Furbearer Sign Station Survey.

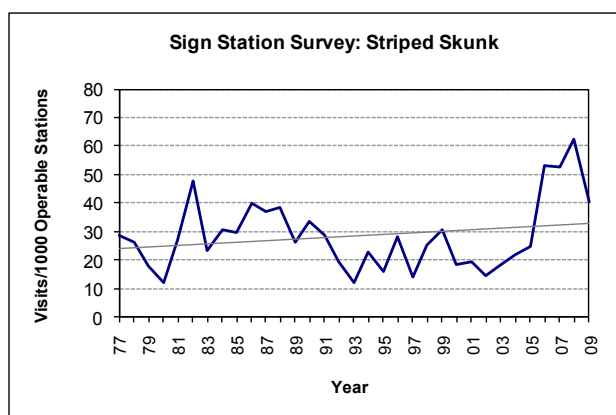


Figure 5. Skunk population trend based on annual Furbearer Sign Station Survey.

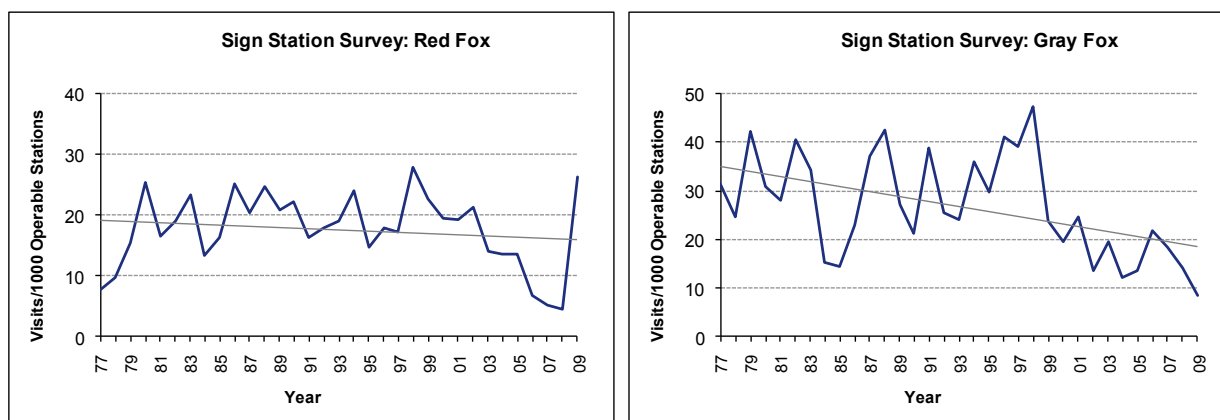


Figure 6. Red and gray fox population trends based on annual Furbearer Sign Station Survey.



## ARCHER'S INDEX TO FURBEARER POPULATIONS

### MONITORING FURBEARER TRENDS USING DATA GATHERED FROM COOPERATOR BOWHUNTERS

Liz Forbes, Resource Assistant, Missouri Department of Conservation

#### Introduction

For 27 consecutive years (1983-2009), the Department has conducted annual surveys of wildlife populations via the archer's diary survey. Each fall, several thousand archery deer and turkey hunters keep daily sighting records for furbearers, other small game animals, deer, and wild turkeys. Archers volunteered to sign up through post-season surveys of archery deer and wild turkey permit holders, articles in the *Missouri Conservationist* magazine, and during sign-ups at bowhunter club meetings and other outdoor events. Archery hunters are asked to record the number of hours they hunted, during both morning and evening hunts, and to use a standardized daily diary to record hours and sightings of wildlife. The Department uses the number of sightings of each species divided by the total number of hours hunted statewide to calculate a sighting rate, and this is expressed as the number of sightings per 1,000 hunter hours to calculate population indices.

Wildlife population indices calculated from the archery's diary survey prove to be relatively precise for high-density terrestrial wildlife such as squirrels, white-tailed deer, wild turkeys, coyotes, raccoons, foxes, and bobcats. Hunter retention rates in the program are very high, and only occasional sign-ups are needed to maintain sufficient hunter hours. Hunters are well distributed statewide, with volunteer hunters in 112 of the 114 counties during most years. Hunter hours averaged 53,157 hours over the last 27 years, and they ranged from a low of 30,990 in 1985 to a high of 84,497 in 1988 (Table 1).

Table 1. Hunter hours and furbearer population indices based on archer diaries, 1983-2009.

YEAR	Hunter Hours	Coyote	Red Fox	Gray Fox	Bobcat	Raccoon	Opossum	Striped Skunk	Mink	Beaver	Muskrat	Weasel	Badger	Otter	Black Bear
1983	55,374	20.0	6.5	5.1	1.7	23.8	12.6	5.0	0.7	0.3	0.5	0.1	0.1	0.0	0.0
1984	32,746	18.8	6.8	3.1	1.2	16.9	6.4	3.5	0.3	0.3	0.1	0.0	0.1	0.0	0.0
1985	30,990	20.1	5.3	2.8	1.5	15.4	8.6	4.2	0.5	0.4	0.4	0.1	0.1	0.1	0.0
1986	51,727	23.5	5.7	2.8	1.5	15.3	6.9	3.5	0.3	0.4	0.0	0.0	0.0	0.0	0.0
1987	57,457	23.5	4.5	2.5	2.0	23.3	10.1	3.0	0.3	0.7	0.2	0.1	0.1	0.1	0.0
1988	84,497	22.4	4.7	2.4	1.7	16.7	4.8	2.7	0.3	0.6	0.1	0.0	0.1	0.1	0.0
1989	72,992	21.1	5.1	2.4	1.8	19.6	5.6	3.5	0.1	0.6	0.1	0.0	0.2	0.1	0.0
1990	72,227	23.6	4.9	2.3	2.9	24.0	7.2	3.5	0.2	0.4	0.1	0.0	0.1	0.1	0.0
1991	64,434	26.1	4.7	3.0	3.3	30.5	11.7	4.0	0.3	0.3	0.1	0.0	0.1	0.0	0.1
1992	64,452	22.5	4.7	2.3	2.9	24.3	8.9	2.8	0.6	0.7	0.1	0.0	0.1	0.3	0.0
1993	53,857	19.7	4.2	2.1	3.2	28.1	7.7	3.7	0.2	0.5	0.2	0.0	0.1	0.3	0.0
1994	49,102	21.0	5.1	2.0	3.4	32.0	7.6	3.2	0.1	0.5	0.2	0.0	0.2	0.2	0.0
1995	66,106	22.3	4.6	2.1	3.8	36.5	9.6	3.6	0.1	0.3	0.1	0.0	0.1	0.3	0.1
1996	60,077	19.6	4.5	1.8	4.1	29.7	6.6	2.7	0.0	0.3	0.0	0.0	0.1	0.5	0.0

Table 1 (continued). Hunter hours and furbearer population indices based on archer diaries, 1983-2009.

YEAR	Hunter Hours	Coyote	Red Fox	Gray Fox	Bobcat	Raccoon	Opossum	Striped Skunk	Mink	Beaver	Muskrat	Weasel	Badger	Otter	Black Bear
1997	47,816	18.0	4.0	2.0	4.5	31.2	7.4	2.7	0.1	0.4	0.0	0.0	0.1	0.6	0.0
1998	43,152	20.8	4.1	2.4	4.4	33.0	10.6	4.2	0.1	0.3	0.1	0.0	0.2	0.3	0.1
1999	44,012	29.2	3.7	2.2	4.8	45.9	12.5	4.0	0.2	0.3	0.1	-	0.1	0.5	-
2000	50,795	20.0	3.7	2.0	4.9	32.1	8.1	3.3	0.0	0.2	0.0	0.0	0.1	0.3	0.0
2001	47,023	19.5	3.6	2.1	5.2	38.7	8.2	4.7	0.1	0.4	0.0	0.0	0.1	0.3	0.0
2002	42,826	24.6	3.8	1.5	7.9	42.6	14.4	5.6	0.3	0.1	0.0	0.0	0.1	0.8	0.1
2003	39,964	20.5	2.7	1.5	6.0	37.9	7.2	3.2	0.1	0.1	0.0	0.0	0.2	0.6	0.0
2004	35,071	17.6	2.8	1.1	4.7	37.3	7.9	2.6	0.1	0.1	0.1	0.0	0.1	1.2	0.0
2005	68,440	21.2	2.8	1.3	5.6	37.3	8.5	2.5	0.1	0.3	0.0	0.0	0.1	0.5	0.0
2006	60,040	22.2	3.2	1.3	6.9	54.4	14.4	3.8	0.3	0.2	0.0	0.0	0.1	0.5	0.0
2007	50,390	19.8	3.0	1.5	5.2	40.0	9.4	4.0	0.0	0.1	0.0	0.0	0.1	0.4	0.0
2008	44,471	16.3	2.6	1.2	5.0	41.5	7.8	3.7	0.1	0.1	0.1	0.0	0.4	0.3	0.0
2009	44,919	20.6	2.6	1.2	4.9	42.0	12.4	4.4	0.1	0.1	0.1	0.0	0.2	1.2	0.1

Line graph representations of archer indices for several furbearer species are shown in Figure 1. Based on these indices, raccoon, bobcat, and opossum populations show a steady rise. Striped skunk and coyote populations are holding relatively steady, while graphs indicate a downward trend for red and gray fox populations. Wildlife population indices by county are shown in Table 2. The data in this table are given to cooperator archery hunters when new diary surveys are mailed to them.

Figure 1. Population trends of some furbearing species based on archer indices.

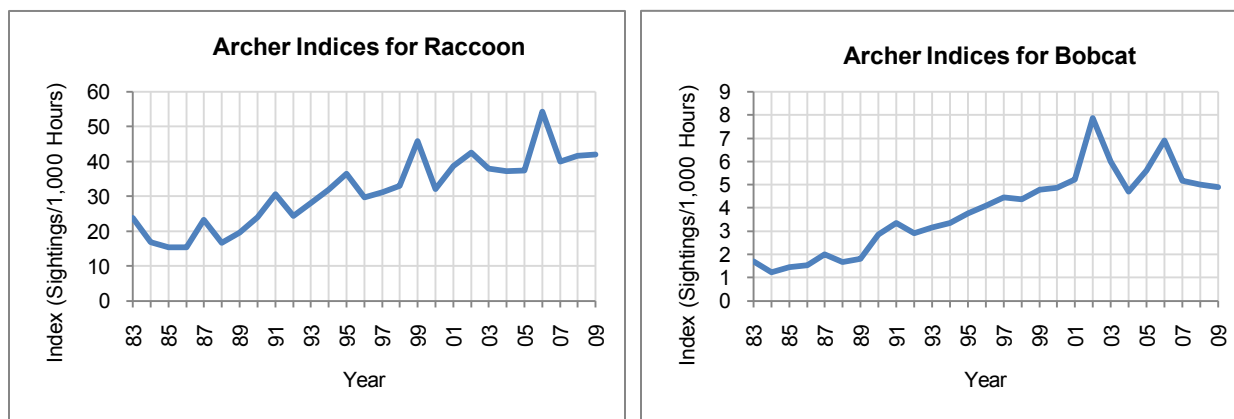


Figure 1 (continued). Population trends of some furbearing species based on archer indices.

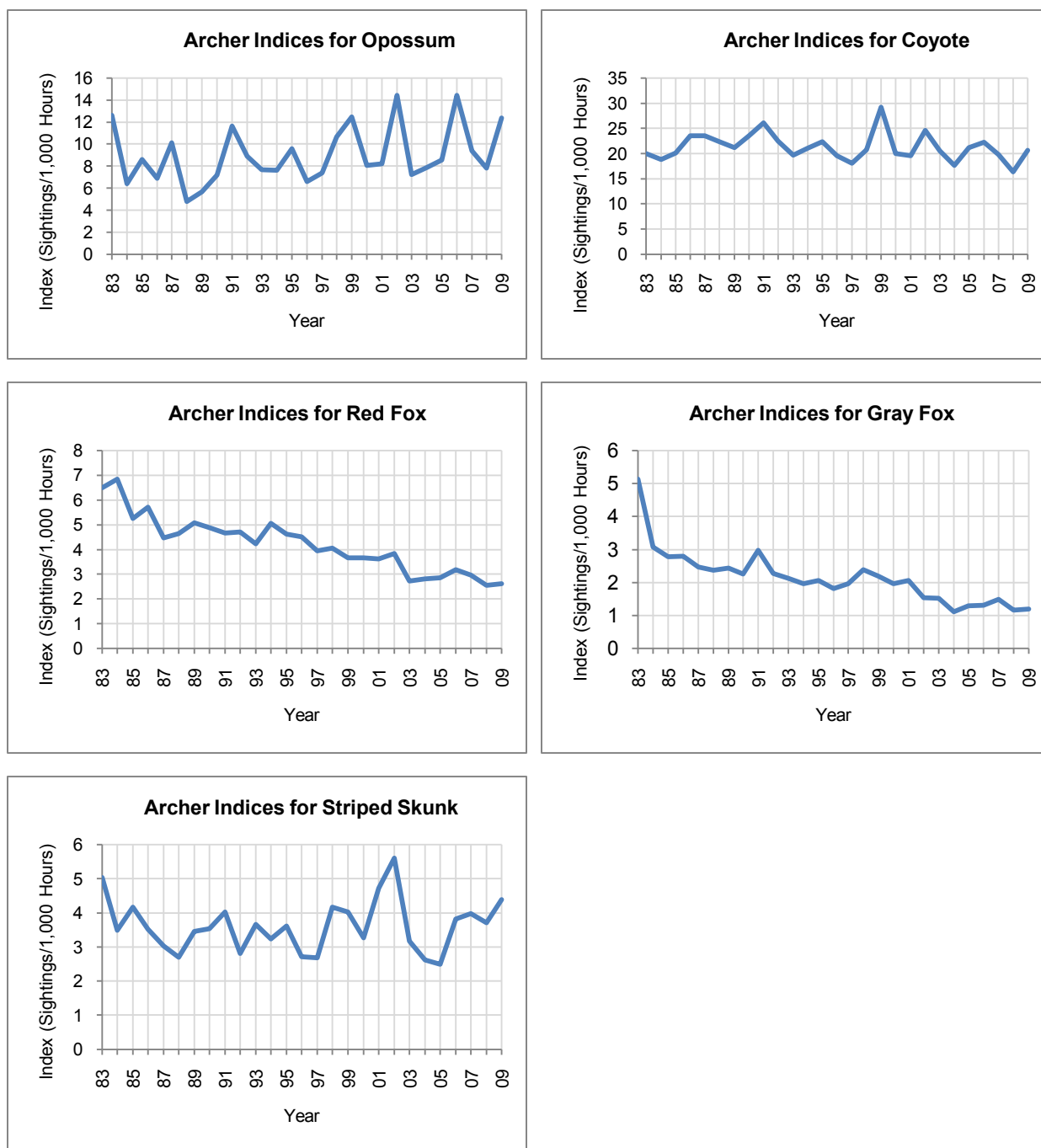


Table 2. County wildlife Indices for 2009 based on sightings by cooperators archery hunters (sightings/1,000 hours).

County	Deer	Turkey	Coyote	Raccoon	Opossum	Red Fox	Gray Fox	Bobcat	Badger	Bear
Adair	1046	339	21	46	6	4	2	10	0	0
Andrew	910	1144	19	65	14	0	0	11	0	0
Atchison	1115	606	35	77	49	0	0	7	0	0
Audrain	684	306	11	132	11	8	0	0	0	0
Barry	519	65	9	43	11	0	0	6	0	0
Barton	1751	858	61	67	0	0	0	11	0	0
Bates	318	202	49	16	13	0	0	2	2	0
Benton	722	476	35	28	10	0	0	1	0	0
Bollinger	492	450	41	41	12	5	0	7	0	0
Boone	698	166	13	22	20	2	9	2	0	0
Buchanan	655	40	76	91	50	20	0	0	0	0
Butler	489	464	0	9	0	0	0	9	9	0
Caldwell	1153	258	69	26	9	0	0	26	0	0
Callaway	574	309	11	14	19	2	1	0	0	0
Camden	588	455	16	38	4	0	4	4	0	0
Cape Girardeau	349	446	47	42	6	0	14	3	0	0
Carroll	663	307	13	93	22	0	0	13	4	0
Carter	281	247	0	49	0	0	5	5	0	0
Cass	330	879	17	34	11	0	3	8	0	0
Cedar	593	762	11	50	22	7	0	4	0	0
Chariton	976	160	29	78	11	0	0	5	0	0
Christian	330	190	24	13	0	3	0	0	0	0
Clark	637	253	17	34	5	2	0	0	0	0
Clay	978	749	0	89	27	7	0	3	0	0
Clinton	1196	691	68	125	8	14	8	5	0	0
Cole	537	179	7	75	15	0	0	0	0	0
Cooper	1527	675	40	85	20	6	0	0	0	0
Crawford	511	350	19	32	9	0	0	1	0	0
Dade	255	347	25	13	0	0	0	17	0	0
Dallas	1404	304	0	0	0	0	12	0	0	0
Daviess	738	563	28	34	11	0	0	17	0	0
DeKalb	664	833	43	52	18	0	0	0	0	0
Dent	747	483	21	21	0	0	0	0	0	0
Douglas	884	720	10	21	0	0	0	10	0	0
Dunklin	182	0	0	0	0	0	0	0	0	0
Franklin	569	397	16	32	11	5	1	8	0	0
Gasconade	722	422	4	52	19	0	0	4	0	0
Gentry	751	247	27	85	45	0	4	4	0	0
Greene	401	571	7	24	5	0	0	2	0	0
Grundy	689	235	0	0	0	17	0	0	0	0
Harrison	736	264	8	46	11	13	0	3	0	0
Henry	1018	384	98	84	20	1	0	8	0	0
Hickory	997	116	6	3	9	0	0	16	0	0
Holt	813	1173	22	4	9	0	0	9	0	0
Howard	1117	778	18	44	14	0	0	4	0	0
Howell	872	173	7	12	0	0	0	12	0	0
Iron	119	465	0	40	0	30	0	30	0	30
Jackson	869	378	18	43	12	2	2	10	0	0
Jasper	899	937	7	90	40	12	0	2	0	0
Jefferson	307	141	14	12	8	4	0	2	0	0
Johnson	1253	549	35	87	12	6	0	12	0	0
Knox	903	542	23	38	10	3	0	5	0	0
Laclede	407	375	4	18	0	0	4	4	0	0
Lafayette	296	238	12	77	19	0	0	0	0	0
Lawrence	1373	441	0	11	27	0	0	0	0	0
Lewis	826	176	10	27	16	6	0	0	0	0
Lincoln	791	503	18	55	10	0	0	4	0	0
Linn	1601	449	9	36	25	0	0	0	0	0

County	Deer	Turkey	Coyote	Raccoon	Opossum	Red Fox	Gray Fox	Bobcat	Badger	Bear
Livingston	700	464	24	53	10	5	0	19	0	0
McDonald	364	0	0	19	0	0	0	0	10	0
Macon	885	231	16	47	10	0	1	2	0	0
Madison	527	432	7	22	0	7	2	2	0	0
Maries	846	717	8	8	18	0	0	8	0	0
Marion	1183	772	30	45	20	3	0	0	0	0
Mercer	1213	785	23	57	19	0	0	8	6	0
Miller	602	459	16	36	20	0	0	0	0	0
Mississippi	1667	2500	0	0	0	0	0	0	0	0
Moniteau	690	915	40	15	0	0	0	15	0	0
Monroe	740	424	34	84	27	9	4	0	0	0
Montgomery	647	340	25	25	13	2	0	3	0	0
Morgan	566	202	0	12	7	0	5	0	0	0
New Madrid	--	--	--	--	--	--	--	--	--	--
Newton	860	97	20	13	9	2	0	2	0	0
Nodaway	1072	867	33	90	21	26	3	8	3	0
Oregon	472	293	7	14	0	4	0	4	0	0
Osage	749	589	21	59	15	8	0	8	0	0
Ozark	527	152	5	92	0	0	0	0	0	0
Pemiscot	500	0	0	0	0	0	0	0	0	0
Perry	991	572	9	32	3	0	0	0	0	0
Pettis	862	862	13	71	25	2	0	6	0	0
Phelps	712	361	21	13	2	0	0	5	0	0
Pike	952	396	8	31	19	4	0	4	0	0
Platte	900	324	5	63	9	0	0	2	0	0
Polk	704	503	11	32	11	0	0	0	0	0
Pulaski	1561	375	12	21	17	4	4	4	0	0
Putnam	686	239	25	25	7	7	0	4	0	0
Ralls	776	265	45	28	13	3	0	23	0	0
Randolph	834	292	27	37	9	5	0	0	0	0
Ray	836	1015	30	103	33	3	6	6	0	0
Reynolds	288	103	23	6	0	0	0	6	0	0
Ripley	226	198	7	78	7	0	0	0	0	0
St. Charles	614	410	8	92	24	0	0	4	0	0
St. Clair	594	340	8	17	4	0	0	4	0	0
St. Francois	288	630	5	10	15	0	0	15	0	0
Ste. Genevieve	461	454	15	20	6	0	0	6	0	0
St. Louis	601	98	9	17	5	1	0	0	0	0
Saline	1244	329	28	61	41	0	0	8	0	0
Schuyler	681	436	0	27	0	5	0	0	0	0
Scotland	1121	368	2	64	14	0	0	7	0	0
Scott	1231	0	0	0	0	0	0	0	0	0
Shannon	350	399	14	0	0	0	0	7	0	0
Shelby	1060	112	20	66	7	5	0	0	0	0
Stoddard	2162	263	11	64	11	0	0	0	0	0
Stone	161	435	0	0	0	0	16	16	0	0
Sullivan	1857	553	6	14	6	3	0	0	0	0
Taney	596	366	23	13	3	3	10	3	0	0
Texas	361	109	19	31	0	0	0	6	0	0
Vernon	920	1236	18	170	18	0	0	7	0	0
Warren	275	248	11	14	3	1	0	1	0	0
Washington	127	110	10	12	2	0	5	5	0	0
Wayne	581	318	20	17	7	7	3	2	0	2
Webster	716	274	47	31	63	0	8	0	0	0
Worth	2113	746	197	127	85	0	0	0	0	0
Wright	530	742	22	26	11	0	2	2	0	0
Statewide Index (Sightings/1000 hours)	<b>758.9</b>	<b>418.2</b>	<b>20.6</b>	<b>42.0</b>	<b>12.4</b>	<b>2.6</b>	<b>1.2</b>	<b>4.9</b>	<b>0.2</b>	<b>0.1</b>



## BLACK BEAR DISTRIBUTION & STATUS

### BLACK BEAR DISTRIBUTION AND STATUS

Jeff Beringer, Resource Scientist, Missouri Department of Conservation  
Liz Forbes, Resource Assistant, Missouri Department of Conservation

#### Summary

We completed a new management plan for black bears in Missouri in 2008. The plan was drafted and approved by a multiagency group of resource professionals from the Missouri Department of Conservation, U.S. Forest Service, National Park Service, and Missouri Department of Natural Resources during summer of 2008 and signed and approved by MDC administration during fall of 2008.

Program goals and objectives outlined in the management plan were:

Black bear goal/vision statement:

*To encourage black bear population expansion within their natural range in Missouri, and to manage black bears consistent with the available habitat and within the limits of human tolerance.*

Black bear program objectives:

1. Increase knowledge about current black bear population status in Missouri.
2. Increase knowledge of black bear ecology in Missouri, how they move, disperse, and travel on a landscape level and identify source and sink populations.
3. Develop black bear conservation and management strategies based on information gathered through research, monitoring, and surveys.
4. Educate Missouri's public, the media, and other resource professionals in Missouri and the Midwest about black bears and Missouri's black bear management program.



Bear track next to shoe print.

The entire black bear management plan can be viewed on at:

<http://mdc4.mdc.mo.gov/Documents/19701.pdf>

We plan to increase outreach efforts to better inform the public about black bear biology and living with bears. MDC has run three All Outdoor stories, and the Department has had three TV media stories and 5 newsprint stories about bears in Missouri. The Department gave seminars on black bears to three non-governmental organizations and are currently revising black bear information on MDC's web site. Public

observations of black bears and black bear cubs continue to increase, and over the last 12 months the Department has received 85 reports of bear sightings. Recent sightings data are being recorded as UTM coordinates so sightings can be easily mapped.

We also submitted a research proposal designed to quantify black bear numbers and sex ratios in parts of southern Missouri. The proposal can be viewed on SharePoint at:

[http://mdcsharepoint/sites/resource/science/Documents/Division%20Administration/Programs%20and%20Projects/FY11%20Projects/One%20Page%20Proposals/Bearpopest\\_FY11%20One%20Pager.docx](http://mdcsharepoint/sites/resource/science/Documents/Division%20Administration/Programs%20and%20Projects/FY11%20Projects/One%20Page%20Proposals/Bearpopest_FY11%20One%20Pager.docx)



## TRAPPING MATTERS WORKSHOP

### EVALUATION OF THE 2009 TRAPPING MATTERS WORKSHOP

Liz Forbes, Resource Assistant, Missouri Department of Conservation

#### Background

Public opinion on trapping is often clouded by misinformation. The goal of the Trapping Matters Workshop is to provide wildlife professionals with the skills they need to communicate the importance of trapping as a wildlife management tool.

Since 2004, we have offered several Trapping Matters Workshops. The 2009 workshop was held on September 22 at the Missouri Department of Conservation (MDC) office in Kirksville. The workshop was attended by 31 MDC employees and two University of Missouri staff members. Attendees included wildlife biologists, private land conservationists, naturalists, and conservation agents.

The workshop, a joint effort by MDC and the Association of Fish and Wildlife Agencies (AFWA), was organized by Liz Forbes (MDC Resource Science Division) and Bryant White (AFWA). Workshop presenters included:

- *Samara Trusso*, wildlife management supervisor for the Pennsylvania Game Commission, discussed the benefits of regulated trapping as a wildlife management, conservation, and research tool. She also explained the most effective messages to use when talking about trapping to the public.
- *Bryant White*, furbearer research coordinator with AFWA, covered the extensive scientific research in the development of Best Management Practices (BMPs), which recommend the most selective and humane traps.
- *Doren Miller*, president of the Missouri Trappers Association (MTA), talked about the role of the MTA. He also gave a skinning demonstration and discussed the preparation of fur for market.
- *Rick Tischafer*, a certified trapper education instructor, gave a hands-on presentation covering the various traps such as cage, foothold, enclosed foothold, and body-gripping.

#### Evaluation Results and Discussion

At the end of the workshop, participants were asked to provide feedback through an evaluation form. Twenty-nine evaluation forms were returned. Respondents rated each speaker from 1 (very poor) to 5 (very good), and all speakers received an average rating of 4.5 or higher.

Participants were asked about the knowledge they gained as a result of the workshop and if they would use this knowledge. A summary of the responses are shown in Table 1.

When asked what information they found surprising, seven participants mentioned the extensive research behind the development of trapping BMPs. Public attitudes toward trapping, how to talk about trapping, and trap types were each mentioned twice among the participants.

Table 1. Summary of responses regarding knowledge gained during the Trapping Matters Workshop.

As a result of the workshop, do you feel you:	Number of Responses		
	Yes	No	Unsure
Know the benefits of regulated trapping as a management tool?	29	0	0
Know how trapping is used to manage wildlife in your state?	28	0	1
Understand how to address trapping issues with stakeholders and the public?	29	0	0
Will use this information in your job?	28	0	1

When reviewing responses to what other information should be added, trapping techniques and Missouri trapping regulations were mentioned four and three times, respectively. While the purpose of the workshop was not to teach trapping techniques and regulations, future workshops could include a brief introduction to these topics.

Based on workshop evaluations, participants walked away with a solid understanding of how to convey the importance of trapping as a wildlife management tool. This knowledge will be useful whenever staff receive a wildlife damage complaint from the public or are questioned by the media about our agency's trapping policies.

Additional Trapping Matters Workshops are planned. Missourians look to MDC for answers about trapping issues, and the Trapping Matters Workshop is an effective way to provide staff with the background and skills they need to have these answers.



Doren Miller demonstrates fur preparation during the Trapping Matters Workshop.



## REDUCING OTTER USE OF SMALL PONDS

### REDUCING OTTER USE OF FARM PONDS AND SMALL IMPOUNDMENTS

Dan Dobesh, Resource Assistant, Missouri Department of Conservation

#### Background

Objectives of Otter Use of Farm Ponds and Small Impoundments Project in Missouri include:

- Describe the extent and nature of otter depredations on fish in ponds and small impoundments in Missouri.
- Describe the biological and physiographic features of ponds and small impoundments in Missouri that have been depredated by otters and determine which variables are highly associated with otter depredation. Assess methods for pond and lake owners to reduce otter depredations on fish.
- A quarter-acre pond located at the Green Conservation Area was selected as the primary research site for this project. A six foot tall perimeter fence was constructed around the pond with the intent of keeping otters inside for observation.



Green Area pond used for otter trap testing.

Otters have been kept and observed in the pen at various times over the past four years. Scat counts of the captive otters conducted from January to June 2007 showed that each otter excreted approximately 5.5 scats per day. It was also noted that the pond had to be restocked every 3-4 weeks with 150-300 catfish. This is an indicator of the extent of depredation that can occur in small ponds.

Also during this time, various trap designs were introduced to test their effectiveness at capturing otters. Most traps consisted of coated 1x1 in. wire cages attached to a dock. Frames of the cages were built with sealed PVC and floated well. A submerged entry method using a funnel design (similar to a minnow trap) proved ineffective, as otters were simply too powerful and nimble to be held by the close-behind wiring on the end of the funnel. One-way, spring loaded, submerged entry doors became the focus of much of the design work, and three different types were tried: Plexiglass doors, heavy wire doors (cage material), and iron welded doors with vertical bars. Another tested trap design was basically a floating platform (5x5 ft.) with a Plexiglass one-way entry in the center going down into the cage. The most successful traps were the Plexiglass and iron welded one-way submerged door designs. However, none of the designs met expectations and it was recommended that more traps be tested.

Based on the information gathered in 2007, we expanded our research efforts at the Green Area otter enclosure. In February 2008, Resource Science began working with Matthew Dekar, a graduate student from the University of Arkansas. His doctoral project is studying the seasonal metabolic expenditures of river otter. Metabolic rates from free-living otters have not been calculated preventing accurate

estimation of consumption in wild otters. Therefore, assisting with this project gave us the opportunity to learn more about the possible extent of otter depredation in small ponds.

For this study we trapped three otters, one from Eagle Bluffs Conservation Area and two from a private pond west of Columbia. Upon capture the otters were taken to a veterinarian where they were injected with doubly-labeled water and background and initial blood samples were drawn. The otters were then released in the Green Area otter enclosure before being re-trapped three days later. Upon recapture, the otters were taken back to the veterinarian, where final blood samples were drawn. The blood samples were taken to Arkansas for analysis of CO<sub>2</sub> production and energy metabolism, which was translated into biomass consumption rates. Analyses showed that the largest male otter that was held in the enclosure consumed approximately 5.5 lb of biomass per day, which was approximately 27% of his body weight. To date, this is the only consumption rate that has been estimated. However, once the analyses are complete, a consumption model can be developed that will allow researchers and managers to estimate the amount of each prey type consumed throughout the year. In addition, consumption estimates will give insight into the ecological constraints regulating otter populations. Finally, data from the studies will highlight important interactions and impacts of otters on prey populations, including sport fishes.

The other aspect of research performed was the testing of another trap design. This trap was a floating, top-entry design. The trap was placed in the pond at the Green Area otter enclosure (un-baited) as well as at Blind Pony Lake (baited). Trail cameras were used to monitor how otters interacted with the trap at both locations. However, based on the photographic evidence, it appears that no otters approached the trap. We are unsure why the otters did not inspect the trap. It is possible they had seen traps before and, therefore, avoided it, or the otters were not using the areas where we placed the trap. Further testing will continue with this trap design at different locations.

## Progress to Date

We continue to test the floating, top-entry design trap at the Green Area and at a private pond. It appears that the otters will enter the trap when it is baited with live fish, but are able to escape. The original design used plastic fish throats, which are funnels of split plastic, as the entry mechanism. Additional modifications of this design are being tested.

The next phase of the study will involve constructing an entry mechanism consisting of a hinged one-way Plexiglas door inside an 8"-6" PVC pipe reducer. Otters seem to be less inclined to enter a trap if they cannot see through the door. In the new design, the Plexiglas door will be held out of the water so it does not get covered in algae (a problem in earlier trap designs). With this design, we are attempting to use of the knowledge we have gathered that otters will go into a top-entry trap and have difficulty getting out of a Plexiglas door to construct a trap that the otters will go into that is sealed in a way that they cannot escape.



Floating, top-entry otter trap design

A new trap design made of steel is currently being tested at a private pond which shows consistent otter sign. The trap is equipped with a locking spring-loaded door and removable bait cage. A game camera will monitor otter interactions with the trap over the next few months. Testing of the trap began in April 2010 and will continue through autumn. If the new design proves effective, we will have two different traps which potentially can be used by private pond owners.



## OTTER SCAT/ GAMEFISH SURVEY

### OTTER SCAT AND GAMEFISH SURVEY 2008-2010

Dan Dobesh, Resource Assistant, Missouri Department of Conservation

#### Background

The impact of river otters (*Lontra canadensis*) on certain fish populations in Missouri has been a subject of much discussion and speculation. The impact on sport fish populations in the Missouri Ozarks, particularly populations of black bass and rock bass, is of great public concern to local anglers. River otter scat and latrine surveys began in the summer and early autumn of 2003 to assess the relative abundance and distribution of otters throughout the Ozark region. A total of ten waterways, selected due to high angling pressures and public concern about otter predation, were sampled on two separate occasions as a pilot study in 2003. Scat densities were found to range from 4.6 per linear mile to 67 per linear mile in 2003. Our current surveys have detected a marked decrease in scat and latrine densities has been apparent on a few waterways for which previous data existed, possibly due to increased trapping pressure along these waterways. Associated sampling data from electro-fishing efforts suggest wide variation in populations of black bass and rock bass, with both high and low densities of fish previously found in areas with relatively high densities of otter scat. Also, variation in levels of otter activity among and within the sampled waterways seems to indicate that where declines in sport fish populations in the region have been documented causes are likely due to a multitude of factors, including otter depredation.

A study of river otter food habits in Ozark streams indicates that otters do prey on sport fish populations at a higher rate than originally believed. However, river otter populations are beginning to decline in some streams due to focused otter harvest in targeted areas via otter trapping zones and encouragement.

The purpose of this study is to assess the relationship between estimated otter population sizes and associated counts of fresh otter scat deposits and the possible use of latrine surveys as a cost-effective index to otter populations in Ozark streams.



#### Methods

Eight rivers (Roubidoux, Big Piney, West Piney, Current, Niangua, Osage Fork, Courtois, and Maries) were surveyed for otter scat as an index of abundance from 2008 to 2010. A crew of four otter survey technicians floated 13.9-mile to 21.4-mile segments of each river marking all latrine sites. Mileages were obtained from either the *Paddler's Guide* or ArcMap calculations. The crew began their field work in January and continued through April each year.

The technicians divided up into two groups, each group using one canoe. One group would float the right side of the river while the other floated the left side. When a latrine site was discovered, the two groups met at the latrine so data could be recorded.

Once a latrine was found it was given a unique identification number, flagged, and its location entered into a GPS unit. A code was developed using a series of 10 letters and numbers to enter into the GPS (Appendix A). All existing scats at the latrine were cleaned off the site. After a segment of river had been floated and the latrines marked and cleaned, the crew returned after five days to count the scat that had accumulated at each latrine. Scats were also collected from each active latrine for DNA analysis. To calculate an index of abundance, the number of scats counted along each river was divided by the length (in miles) of the surveyed segment to get the number of scats per mile. A complete protocol checklist was created for technicians to follow so that latrines were always marked the same way (Appendix B).

## Results

A total of 1,844 scats were counted at 290 latrines during the 2010 survey period. Approximately 70 percent of latrines that were found during the initial survey were considered to be active (had scat) at the time of the scat counts five days later. These numbers are much higher than results from the past two years (2008-2009). A total of 492 scats were counted at 118 latrines in 2008. Approximately 66 percent of these latrines were considered active. In 2009, a total of 1,395 scats were counted at 210 latrines with only 47 percent of these latrines considered to be active. In past years, the Osage Fork of the Gasconade River has had the greatest index of otter abundance. In 2009, this river had an otter scat index of 16.1 scats per mile. This year, the river segment with the greatest index of otter abundance was the Current River with a scat index of 29.9 scats per mile. The river with the lowest index of abundance was the Courtois, with 2.5 scats per mile. All but one river sampled in 2010 showed an increase in otter sign. Rivers with the highest increase were the Roubidoux, Big Piney, and Current rivers having 1,377%, 752%, and 453% higher scat indices respectively, while the Osage Fork of the Gasconade showed a 68% decrease. The Osage Fork of the Gasconade was the only river in 2010 to show a decrease in otter scat sign. Comparison of data to years prior to 2008 was difficult due to surveying different segments of river and differences in index calculation. Exact scat per mile numbers from years 2008 to 2010 are listed in Table 1.



Otter scat indices have been compared in five river segments from 2008 to 2010 as well as the first three years of scat sampling from 2003 to 2005 (Figure 1). These five segments were selected because these were the only segments in which data were available to compare between the two collection periods of 2003-2005 and 2008-2010. Scat surveys were not conducted in 2006 and 2007. The otter scat index in these five river segments has fluctuated around 5 to 15 scats per mile historically. This year, three of the five river segments have exceeded the 15 scat per mile mark. One segment of the Roubidoux River reached 31 scats per mile. Overall results for the survey from 2008 through 2010 show an increasing trend in otter scat indices.

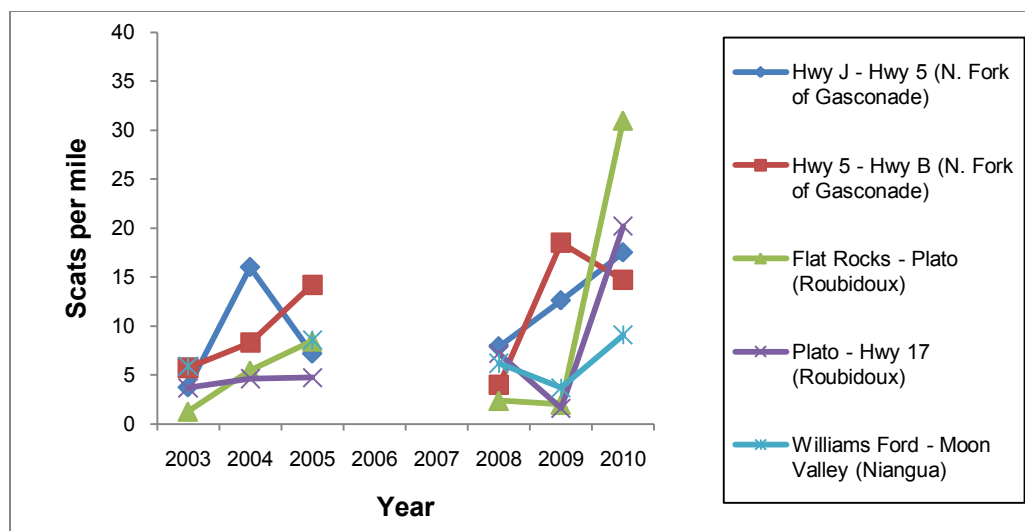


Figure 1. Otter scat index in five river segments.

The number of river otters harvested each year somewhat reflects the average price that a fur trapper can receive for each otter. A record has been kept of all otters harvested and the average pelt price that fur trappers receive at auction. The number of otters trapped from each of the eight surveyed streams over the past seven trapping seasons is represented in Figure 2. Exact harvest numbers of river otters in each of the eight rivers surveyed are shown in Table 2.

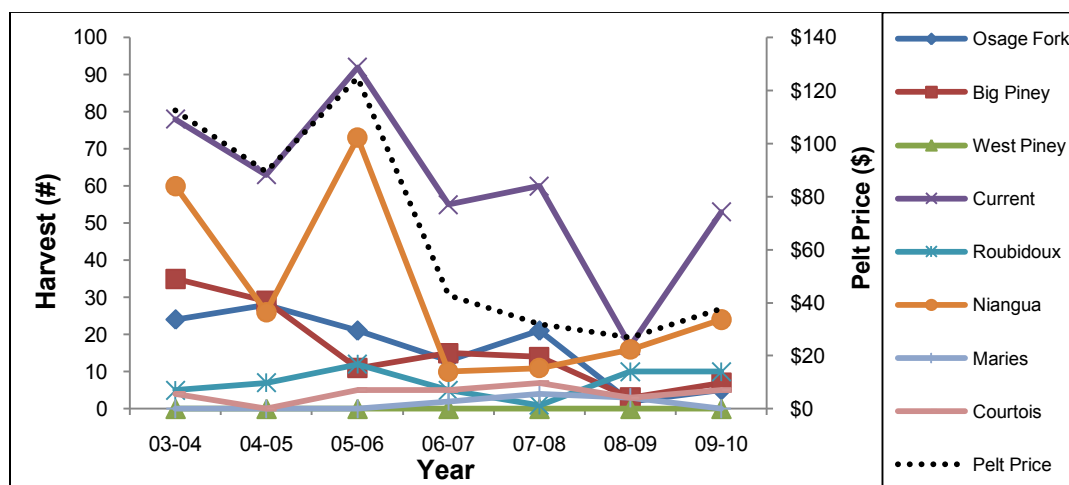


Figure 2. Otter harvest per river surveyed and average otter pelt price.

## Discussion

From 2008 to 2010 eight rivers were surveyed for river otter latrine sites. This method of floating river segments to check for latrine sites provides a good estimation of the number of river otters in the surrounding area of the survey. As shown above, river otter pelt price is a driving factor as to how much trapping pressure otters will receive in a given year. River otter depredation on sport fishes will continue to be an issue, but with knowledge as to how their activity fluctuates with fur prices and trapping effort and information on their diet and when it changes, more can be done to better manage the number of otters in a given area.

Table 1. Scats per mile 2008-2010

River/Segment	Miles surveyed	2008 scats/mile	2009 scats/mile	2010 scats/mile
Osage Fork of Gasconade	19.7	5.6	16.1	15.8
Hwy J - Hwy 5	8	7.9	12.6	17.5
Hwy 5 - Hwy B	11.7	4.0	18.5	14.7
Big Piney	14.6	5.0	2.1	15.8
Baptist Camp - Dogs Bluff	8.7	6.3	1.6	19.8
Dogs Bluff - Mineral Spring	5.9	3.1	2.9	10.0
Current River	17	3.9	6.6	29.9
Akers - Lipps Hole	7.3	2.5	5.2	40.6
Lipps Hole - Sinking Creek	9.7	5.1	7.7	21.9
Roubidoux	21.4	5.1	1.8	24.8
Flat Rocks - Plato (Hwy 32)	9.1	2.4	2	31.0
Plato - Hwy 17	12.3	7.2	1.6	20.2
Niangua	18	3.8	2.6	7.6
Williams Ford - Moon Valley	10.1	6.2	3.7	9.1
Moon Valley - Bennett Spring	7.9	0.6	1.1	5.6
West Piney	15.4	1.1	1.2	2.9
Valleyview – Crawford	8.4	0.6	0	2.9
Crawford - Big Piney	7	1.7	2.6	3.0
Maries River	16.9	0.9	1.7	2.8
Hwy P - Hwy T	8.5	0.8	0.5	4.2
Hwy T - Westphalia (Hwy 63)	8.4	1.0	2.9	1.3
Courtois	13.9	2.3	1.7	2.5
Hwy C - Brazil Rd.	7	1.3	2.1	4.9
Brazil Rd. - Berryman (Hwy 8)	6.9	3.3	1.2	0.1

Table 2. Otter Harvest by River and Average Otter Pelt Price

Otter Harvest by River	Year							
	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10
Osage Fork	24	24	28	21	13	21	2	5
Big Piney	45	35	29	11	15	14	3	7
West Piney	0	0	0	0	0	0	0	0
Current	61	78	63	92	55	60	17	53
Roubidoux	0	5	7	12	5	1	10	10
Niangua	33	60	26	73	10	11	16	24
Maries	1	0	0	0	2	4	3	0
Courtois	1	4	0	5	5	7	3	5
<b>Pelt Price</b>	\$76.97	\$112.45	\$89.25	\$124.92	\$42.77	\$32.00	\$26.91	\$37.80



## USING DNA TO DETERMINE OTTER ABUNDANCE

*Below is an abstract from a study in which the MDC Furbearer Program participated. Information from the study will be presented in Rebecca Mowry's Master's thesis.*

### **A GENETIC APPROACH TO DETERMINE RIVER OTTER (*LONTRA CANADENSIS*) ABUNDANCE IN EIGHT OZARK STREAMS IN MISSOURI**

Rebecca Mowry, Graduate Student, University of Missouri

#### Investigators:

Jeff Beringer, Missouri Department of Conservation

Lori S. Eggert, Division of Biological Sciences, University of Missouri

Matthew E. Gompper, School of Natural Resources, University of Missouri

The reintroduction of apex predators can precipitate direct and indirect ecosystem responses that are often poorly understood. The reintroduction of river otters (*Lontra canadensis*) to Missouri streams has sparked controversy due to unanticipated effects on fish populations. Otter trapping was initiated in 1996 to manage populations and address angler concerns. Early estimates of river otter populations were highly variable and potentially inaccurate, sparking additional controversy. Scat surveys were initiated to measure otter abundance; however, it was unclear how scat indices related to actual otter numbers. To address these issues, we genotyped fecal samples found at latrine



sites to develop a more accurate estimation of population size along eight Missouri streams, then used these estimates to develop a model (Table 1) correlating abundance with latrine site indices (latrine site counts and number of scats per latrine site). Throughout this process, we optimized laboratory protocols for noninvasive genetic analysis of river otter scat samples for population estimation, including redesigning microsatellite primers, calculating genetic error rates, and streamlining the extraction and PCR processes.

In addition to providing insight into the relationship between latrine site indices and population size (Table 2), the data we collected were also used to estimate relatedness of river otters at individual latrine sites and along stretches of river. We were able to make inferences about otter social structure and movement by evaluating patterns of relatedness and gender, using GIS to identify map locations of individual otters and family groups as they moved among latrine sites throughout the sampling period.

Table 1. The top-fitting model used the interaction between scats per latrine and jelly per km ( $r^2 = 0.840$ ) to predict population size.

Model Rank	Model	$\Delta AIC$	$w_i$
1	Scat per latrine * jelly per km	0.000	0.8937
2	Global	6.552	0.0338
3	Scat per latrine + jelly per km	6.625	0.0325
4	Jelly per km + fresh per km + new per km	7.129	0.0253
5	Scat per latrine	9.912	0.0063

Table 2. Population estimations per river/per sampling period. \*\*Lincoln-Petersen estimations: Courtois River – 3 otters; Current River – 11 otters.

	Minimum Pop	CAPWIRE (95% CONF)	Sampling period	Density (per km)
<b>Big Piney</b>				
winter	6	9 (6-16)	mid-Jan, mid-Feb	0.255
spring	12	17 (12-26)	early Apr	0.511
<b>Courtois **</b>	3	3 (3-3)	late Mar-early Apr	0.134
<b>Current **</b>	11	11 (11-11)	early-mid Mar	0.403
<b>Maries</b>	3	3 (3-3)	late Mar, mid-Apr	0.110
<b>Niangua</b>	2	2 (2-2)	mid-Feb	0.069
<b>Osage Fork</b>	14	14 (14-15)	mid-Mar	0.442
<b>Roubidoux</b>				
winter	6	6 (6-6)	mid-Jan	0.174
spring	10	11 (10-13)	mid-Apr	0.291
<b>West Piney</b>				
winter	3	5 (3-10)	mid-Feb	0.121
spring	3	3 (3-3)	early Apr	0.121

Finally, we were able to use latrine site counts and fish population data collected in previous years to examine the relationship between otter and fish abundance, which will lay the groundwork for future studies examining the effects of otters on the aquatic ecosystem. A closer understanding of otter ecology and the effects of otter depredation on sport fish populations is crucial for the development of publicly and ecologically acceptable management activities for the long-term maintenance of Missouri's streams. Of 1,426 scat samples, twenty-four percent could be genotyped across at least 7 loci. The highest genotyping success rate was found in anal jelly samples (71%), followed by old samples (1-6 days old; 24%) and fresh (0-1 day old; 12%). Sixty-three total otters were identified.



## FECAL DNA METHODS FOR OTTER POPULATION ASSESSMENTS

*Below is the abstract from a paper being submitted to the Journal of Wildlife Management.  
The MDC Furbearer Program participated in the study.*

### FECAL DNA FIELD AND LAB METHODS FOR LARGE-SCALE RIVER OTTER POPULATION ASSESSMENTS

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Analyses of fecal DNA to identify individual animals may result in improved population estimates and have been used for a variety of mammalian species. However, analysis of DNA from otters, including the Nearctic river otter (*Lontra canadensis*), remains problematic. We tested and optimized genotyping methods for river otter scat samples, including redesigning existing microsatellite primers to increase genotyping success and to reduce the time needed for large-scale studies through the use of multiplex PCR. Using matched tissue and scat samples, we calculated rates of error from allelic dropout and false alleles, observing low rates of error for the redesigned primers. We compared the success rates of fresh (within one day of defecation) and old (one-six days after defecation) scats, as well as anal sac secretions (anal jelly) over time. Genotyping success at seven or more loci was highest for anal jelly (71%) and lowest for fresh samples (12%) and varied across seasons. Our suite of methods will facilitate large-scale fecal DNA-based research for river otters, and our results suggest that collecting only very fresh scat samples and anal jellies may not be an optimal strategy.





## DIET AND METABOLISM OF RIVER OTTERS

*Below is an abstract from a study in which the MDC Furbearer Program participated. Information from the study will be presented in the Canadian Journal of Zoology.*

### INTEGRATING PREY AVAILABILITY, DIET AND FIELD METABOLIC RATE OF RIVER OTTER (*LONTRA CANADENSIS*)

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<sup>2</sup>Missouri Department of Conservation, Resource Science Center, Columbia, MO, 65201

River otters (*Lontra canadensis*) are important predators in aquatic ecosystems, but few studies quantify their prey consumption. We trapped crayfish monthly as an index of availability and collected otter scat for diet analysis in the Ozark Mountains of northwest Arkansas, U.S.A. We measured otter daily energy expenditure (DEE) with the doubly labeled water method to develop a bioenergetics model for estimating monthly prey consumption. Crayfish (*Orconectes meeki*) catch-per-unit-effort was positively related to stream temperature indicating crayfish were more available during warmer months. The percentage frequency of occurrence for crayfish in scat samples peaked at 85.0% in summer and was lowest (42.3%) in winter. In contrast, the percentage occurrence of fish was 13.3% in summer and 57.7% in winter. Estimates of DEE averaged  $4\,738\text{ kJ}\cdot\text{d}^{-1}$  for an otter with a body mass of  $7\,842\text{ g}$ . Total biomass consumption ranged from  $35\,079\text{ g}\cdot\text{mo}^{-1}$  (wet mass) to  $52\,653\text{ g}\cdot\text{mo}^{-1}$  corresponding to a high proportion of fish and crayfish in the diet, respectively. Otter consumption represents a large fraction of prey production indicating potentially strong effects of otters on trophic dynamics in stream ecosystems.



## BADGERS STATUS IN MISSOURI

### AN EXPLORATORY ASSESSMENT OF BADGER DEMOGRAPHICS AND CONSERVATION STATUS IN MISSOURI

MDC Project Leaders: Jeff Beringer and Liz Forbes, Missouri Department of Conservation

Principle Investigator and Affiliation: Matt Gompper, University of Missouri

Team Members and Affiliations: Debby Fantz (RSD), John George (Wildlife), Greg Gremaud, (Wildlife), Daryl Damron (Private Lands), Nate Mechlin (Private Lands), Larry Rizzo (Wildlife)

#### Need/Justification

The badger is uncommon in Missouri and is considered a species of conservation concern. Its official rank is Unrankable (SU), however, as little data are available to allow an informed ranking. We are conducting an exploratory study to gain badger specimens from across the state. We will use these samples to better understand the demographics and distribution of badgers in Missouri to provide data with which to refine the ranking of badgers in Missouri and in MDC's Natural Heritage Database and to assess the need for additional research by which to better manage the species in Missouri.

The badger is a harvested species in Missouri, but harvest numbers have historically been low (generally fewer than 200 per year since the 1960s and fewer than 100 per year since the 1990s). These low harvests, classification as SU, and general consideration of the badger as a species of conservation concern reflect the rankings of the species in surrounding states. Arkansas ranks the species as S1 (Critically Imperiled), Ohio and Indiana as S2 (Imperiled), and Kansas as S3 (Vulnerable). Iowa ranks the badger as S4 (Apparently Secure), reflecting their apparent increased abundance in the grassland and open habitats that dominate the state. This habitat preference is also seen in Missouri, as the majority of harvested animals are from the northern portion of the state and especially from northwestern Missouri. However, relatively few occurrence locations are documented in Missouri's Natural Heritage Database.

There is widespread concern that the badger has declined substantially in areas converted from grassland to intensive agriculture and where colonial rodents, such as prairie dogs and ground squirrels (both Franklin's and thirteen-lined ground squirrels are also species of conservation concern in Missouri), have been reduced or eliminated. Assessing the validity of this concern in Missouri is hindered by a lack of information because 1) harvest data are insufficient to properly assess trends and 2) little baseline data are available on the biology and demographics of the species. To fill these knowledge gaps, we are proposing an exploratory study using verified sightings from the public and badger carcasses obtained from fur trappers or hit by cars. Information obtained from reported badger sightings



Badger den site in Atchison County.

and collected carcasses will be used to define the range of the badger in Missouri, to make initial and preliminary insights into the demographics of the Missouri population, and to better refine the status of the species in MDC's heritage database.

### Preliminary Results

We have received 161 reports of badgers in Missouri from staff and the public (Figure 1). We included some historical reports from the last decade but most reports were current. We collected 68 carcasses (36 male, 25 female, 7 unknown pending necropsy) from trappers and the public from September 2009 to May 2010. Physical data for necropsied badgers are represented in Table 1. Reproductive and age data will be determined by flushing uterine tracts and tooth cementum analysis, respectively.



Table 1. Physical data from badger carcasses collected in Missouri from November through May 2010.

	<b>Average Lengths</b> (n = sample size)	<b>Average Weights</b> (n = sample size)
Whole (unskinned) carcass	65.0 cm (n=5)	8.7 kg (n=9)
Skinned carcass	59.2 cm (n=43)	5.9 kg (n=47)

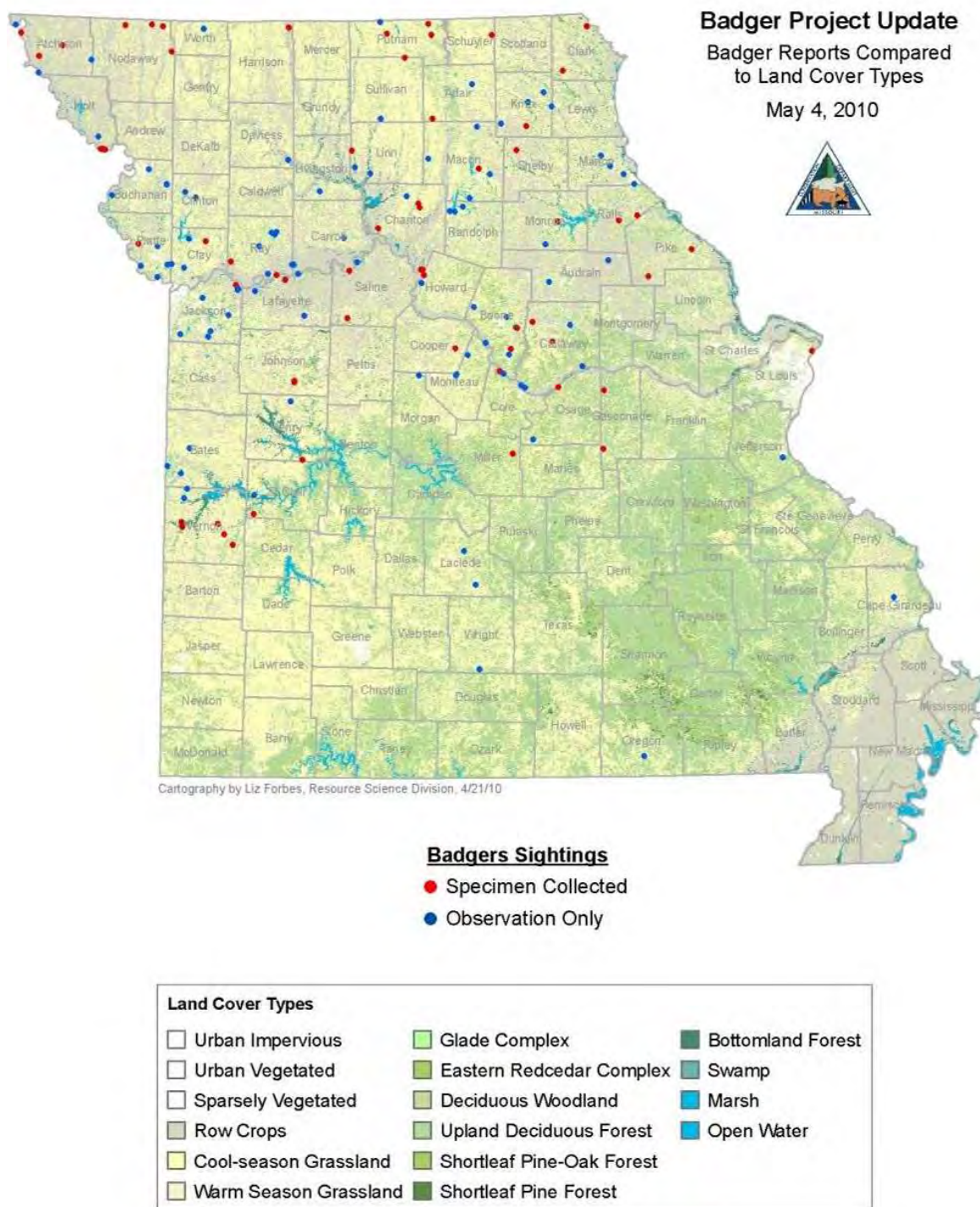


Figure 1. Badger locations based on reported sightings and carcass recoveries from trappers and road-killed animals.



## CHANGING STATUS AND MANAGEMENT OF BOBCATS

*Below is an abstract from a study in which the MDC Furbearer Program participated.  
Information from the study will be presented at the Midwest Fish & Wildlife Conference, 2010.*

### **A TALE OF TWO STATES: CHANGING STATUS AND MANAGEMENT OF BOBCATS IN IOWA AND MISSOURI**

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We reviewed population status and management of bobcats (*Lynx rufus*) in Iowa and Missouri, concentrating on the 1990s to the present. We used harvest data and surveys of archery hunters to document abundance and distribution in both states. We used Iowa telemetry data to assess dispersal and mortality patterns and genetic samples from the Midwest to study linkages in the population. In 1997, bobcats could be legally harvested only south of I-70 in Missouri but became more abundant in northwestern then northeastern Missouri, resulting in a statewide season in 2004. Bobcats were reported with increasing frequency in Iowa in the 2000s. Genetic analyses reveal that bobcats in Iowa are linked with bobcats in northern Missouri, eastern Kansas, and Nebraska. Iowa collared bobcats have been recovered in Missouri. In Iowa, more than 90% of the mortality to marked bobcats is human-caused with the majority due to incidental take of other furbearers. Harvest is unrestricted in Missouri with a peak of 4,453 pelts registered in 2006-07. In 2007, Iowa implemented a quota-controlled harvest in 21 southern counties that balances harvest opportunity with continued expansion of the population. Neither state directly incorporates estimates of incidental take into harvest management. We speculate on whether the harvest in northern Missouri and southern Iowa will affect the rate of expansion in Iowa. This study provides results that support the concept of regional cooperation among agencies in conservation of these vagile carnivores as they repopulate areas where they have been absent or uncommon for many years.



## BOBCATS AND CYTAUXZOOONOSIS

*Below is an abstract from a study in which the MDC Furbearer Program participated.  
Information from the study will be presented at the  
Southeastern Association of Fish & Wildlife Agencies Conference, 2010.*

### GEOGRAPHIC DISTRIBUTION AND PREVALENCE OF *CYTAUXZOOON FELIS* IN WILD FELIDS\*

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<sup>4</sup>West Virginia Division of Natural Resources, Charleston, WV

<sup>5</sup>North Carolina Wildlife Resources Commission, Apex, NC

<sup>6</sup>Missouri Department of Conservation, Columbia, MO

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*Cytauxzoon felis*, a tick-borne protozoal parasite of wild and domestic felids, is the causative agent of cytauxzoonosis in domestic and exotic felids. *C. felis* can be transmitted by two tick species, *Dermacentor variabilis* (American dog tick) and *Amblyomma americanum* (lone star tick). The distribution of these ticks overlap considerably throughout the Southern U.S., but *D. variabilis* ranges farther into northern states. The objective of the current project was to determine the distribution and prevalence of *C. felis* in bobcats (*Lynx rufus*) and other wild/exotic felids from ten eastern states (Georgia, Kansas, Kentucky, Louisiana, Missouri, North Carolina, North Dakota, Ohio, Oklahoma, and West Virginia).

The bobcat is believed to be the primary reservoir for *C. felis*, but few studies have looked at the distribution and prevalence of the parasite within wild felids. Blood and/or spleen samples from hunter/trapper-killed felids (n=420) were tested for *C. felis* by PCR, targeting the ribosomal internal transcribed spacer region 1 (ITS-1). Prevalence was higher in southern states where both tick species are present. The prevalence in Kansas (41 bobcats), Kentucky (74 bobcats), Louisiana (1 bobcat, 1 cougar [*Felis concolor*], 1 serval [*Leptailurus serval*]), Missouri (39 bobcats), North Carolina (8 bobcats), and Oklahoma (20 bobcats) were 27%, 55%, 33%, 79%, 63%, and 60% respectively. The prevalence was lower in West Virginia (0%, 37 bobcats), Ohio (5%, 19 bobcats), Georgia (3%, 69 bobcats), and North Dakota (3%, 114 bobcats).

These data indicate that *C. felis* is widespread in bobcat populations, but the spatial differences in prevalence may relate to differences in the distributions of the two tick species. The ultimate goal of this project is to investigate intraspecific variability of *C. felis* throughout the Eastern U.S. by comparison of ITS sequences present in wild felids with those detected in domestic cats and ticks.



## GENETIC DIVERSITY OF STRIPED SKUNKS

*Below is an abstract from an on-going project in which the MDC Furbearer Program participated.*

### **The Genetic Diversity of Striped Skunk (*Mephitis mephitis*) Populations throughout the Central United States**

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Biology Department, 100 North University Drive, Edmond, OK 73034

The striped skunk (*Mephitis mephitis*) is distributed throughout southern Canada, the United States, and northern Mexico and is one of the main vectors of the rabies virus. Skunks carry three known rabies variants: one in the south-central United States, one in the north-central United States, and one in California. Striped skunks have been the focus of several rabies investigations, but few genetic studies have been performed on this species and none have looked at the potential for genetic subspecies. The immediate goal of this project is to determine levels of genetic variation within striped skunk populations found in the geographic distribution of the south-central strain of rabies in the United States. Currently, skunks are being sampled from Oklahoma, Kansas, Nebraska, Missouri, Texas, New Mexico, North Dakota, Wyoming, California, and Arizona. To determine levels of genetic variation, the D-loop portion of the control region of the maternally-inherited mitochondrial genome is being amplified.

Preliminary data indicate two distinct haplotype groups among samples from Oklahoma, Kansas, New Mexico, and Texas. This research is only the third study of genetic variation within striped skunk populations and the first to be conducted over a wide geographic range (central United States).





## FERAL HOG RESEARCH PROJECT

### FERAL HOG RESEARCH PROJECT

Chuelo Arias, Resource Staff Scientist, Missouri Department of Conservation  
 Jeff Beringer, Resource Scientist, Missouri Department of Conservation  
 Dr. Joshua Millsbaugh, Professor, University of Missouri-Columbia

#### Background

Feral hogs are known to occur in approximately 40 counties in Missouri, with established populations in 19 counties. Feral hogs directly and indirectly damage natural communities, destroy agricultural crops, compete with native wildlife, and serve as reservoirs of disease. Although MDC has been involved in feral hog control since the 1990s, almost no ecological data have been collected. The goal of this project is to provide the movement, survival, and reproduction data necessary to implement more efficient feral hog control measures in Missouri and to provide a scientific basis for future management decisions. The specific goals of the project are to:

1. Determine how resource selection and movement patterns of adult female feral hogs change in response to five specific population control measures (trapping, snaring, Judas pigs, hunting with dogs, and aerial gunning) on public lands in Missouri by comparing habitat utilization distributions of hogs equipped with GPS transmitters before and after each type of control measure.
2. Measure control efficiency, in man-hours, of five control methods: trapping, snaring, Judas pigs, hunting with dogs, and aerial gunning.
3. Estimate survival and fecundity of female feral hogs from data collected through control efforts by MDC staff.

All of the data that we collect will aid in making the ultimate management decision regarding how the Department should address feral hogs in the state. The movement data will tell us where feral hogs are at any given time of year and how they respond to control efforts. The control method efficiency data will tell us which methods are most cost-effective. Biological data collected during control efforts (sex and age data from all hogs killed, and reproductive information from sows) will be used to construct a population model, which will allow us to estimate the hog population size and reproductive rate.

When the research project started, we identified teams of personnel in each region that were already working on feral hog control and it was agreed that we would all work together to continue hog eradication activities and to accomplish the goals of the project. This work team involves personnel from Resource Science, Private Lands, Forestry, and Wildlife Divisions, as well as University of Missouri-Columbia and USDA-Wildlife Services. The research project officially began June 1, 2009.

#### Progress to Date

Since the start of the project, we have captured 249 and euthanized a total of 248 hogs as part of the hog eradication effort. Six hogs that were killed are not included in the table below because they were not taken by one of the methods being evaluated, but they were included in the total number killed. Personnel from nearly all MDC resource divisions, as well as USDA, have cooperated in this effort. A summary of the capture effort and man-hours is presented in Table 1.

Table 1. Summary of capture effort and efficiency in terms of man-hours.

Capture Technique	Man-hours 01 July 2009 - 31 March 2010	# Captured	Man-hours per hog
Traps	2418.5	181	13.4
Snares	257.0	14	18.4
Aerial Gunning	374.5	48	7.8
Hunting with dogs	0.0	0	----
TOTALS	3050.0	243	12.6

We have also captured and released six hogs with tracking collars (see Table 2 for a full summary). The original collars that were going to be used for the project were purchased through Sirtrack, a GPS collar manufacturer out of New Zealand. However, in testing the collars on hogs, we found that the data being collected were insufficient to meet the needs of the project. So, in November 2009, we began testing a collar from another company, called North Star Science and Technology. We found the North Star collar to be far superior to the Sirtrack collars and began transferring the contract from Sirtrack to North Star. As of 26 April 2010, the contract was successfully reassigned and manufacture of the new collars had begun. Unfortunately, dealing with these technical issues has set the movement portion of the project behind an entire year. We anticipate getting the new collars by the end of May 2010 and will immediately start putting them on hogs. This will require a cooperative effort between supervisors and field staff to trap hogs suitable to be collared. We will likely be focusing our efforts around Ketcherside/Taum Sauk/Proffit Mountain, Truman Lake/Roscoe, Hornersville Swamp, and Caney Mountain conservation areas.

Table 2. Summary of hogs captured and fitted with GPS collars.

Capture Site	Capture Date	# GPS locations	Notes
Proffit Mountain	4/29/2009	6	We received a mortality signal from this collar, so Rich Blatz and Dave Hasenbeck went to find it and located the collar, without the hog, on 5/29/09. However, the hog was later re-captured with 8 other hogs and euthanized by Nick RiViello and Jay Simpson on 10/8/09.
Bell Mountain	7/2/2009	63	Hog collared on cooperating private landowner's property with Dan McMurtry from USDA. Tracking the movements of this hog led us to several other small groups. This hog was re-captured and euthanized by another cooperating landowner on 10/10/09.
Proffit Mountain	7/14/2009	42	Hog originally captured with a group of 14 other hogs. This hog was tracked and seen with a large group of approximately 30 other hogs on 10/7/09. This hog was also used as a Judas pig during the 12/11/09 aerial gunning exercise in which 4 of the hogs in her group were euthanized. Collar recovered 1/19/10.
Tumbling Creek/Aley Property	8/5/2009	73	Hog originally captured on private property adjoining the Tumbling Creek Cave COA by James Dixon. Hog was re-captured alone by a neighboring landowner on 12/1/09.
Truman Reservoir/Roscoe	11/20/2009	274	This hog was fitted with a demo collar from North Star, another collar manufacturer. Hog was originally captured with 7 other hogs on private property adjacent to Truman Reservoir Wildlife Area near Roscoe. This hog was used as a Judas pig during the 12/4/09 aerial gunning exercise in which 4 of the hogs associated with her were euthanized. Hog was pregnant when removed during 2/11/10 aerial gunning exercise.
Proffit Mountain	12/1/2009	0	Originally captured with 2 other hogs and was fitted with a new Sirtrack collar for testing purposes. Used as a Judas pig during the 12/11/09 aerial gunning exercise in which it was seen with 2 or 3 other hogs, but none were able to be euthanized. We have not received any data from this test collar and have lost radio communication as well. Helicopter attempted to find this collar during 2/1/10 aerial gunning, but could not pick up the signal.

In February 2010, all movement and biological data that had been collected to that point were taken to Dr. Josh Millspaugh at MU for analysis. Unfortunately there weren't enough biological data at that time to run the population model. We need to catch more hogs over the next two years of the project to be able to collect enough data for the model. To collect additional data for the research project, we recently worked

out an agreement with USDA to collect biological data from the hogs killed by their cooperating landowners. The cooperative effort between USDA and private landowners has resulted in removing 474 hogs in 2009. Collecting data from these hogs will facilitate the development of a robust population model that can be used to predict reproductive rates and population size.

In addition to the biological data, Dr. Millspaugh also analyzed the movement data for three hogs, one adult male, one adult female, and one sub-adult female, each of which had been collared for three months. We implemented the aerial gunning control method on the sub-adult female, but did not implement any control methods on the adult male or female; however, we did monitor home range size for the adult animals. The home ranges of the adult male and female, based on minimum convex polygons created from all points collected by the GPS collar, were 9.87 mi<sup>2</sup> and 3.47 mi<sup>2</sup>, respectively (Figure 1). We found that the male hog had a very well defined core area which was used 81% of the time, but was capable of moving long distances to the edges of his home range, presumably to seek out receptive females. The adult female hog not only had a smaller home range, but also used the area more uniformly. The adult female did show a tendency to spend more time in two discrete areas of her range, with 36% of the points being in the northeast corner of her range and 19% in the southeast, but overall, her movement pattern showed that she would spend 2 – 5 days in one small area before moving to a different part of her range. The sub-adult female was monitored before, during, and after aerial gunning operations and her movement patterns analyzed to determine the effect of the control effort on her movements (Figure 2). In the two weeks before aerial gunning commenced, the hog was consistently using an area approximately 0.55 mi<sup>2</sup> in size, rarely moving more than 0.1 mile per day, with only six consecutive movements of greater than 0.5 mile. During and 24 hours after aerial gunning, she made three consecutive movements of greater than 0.5 mile. After aerial gunning, the hog left the area that she had been occupying and moved approximately 1 mile southeast and remained there for 9 days before returning to her previous core area. Dr. Millspaugh also ran another analysis to graphically and statistically compare movement data before and after aerial gunning (Figure 3). These preliminary data suggest that aerial gunning does alter the movement patterns of hogs, but only temporarily.



Chuelo Arias shown with 11 feral hogs trapped and killed in Reynolds County.

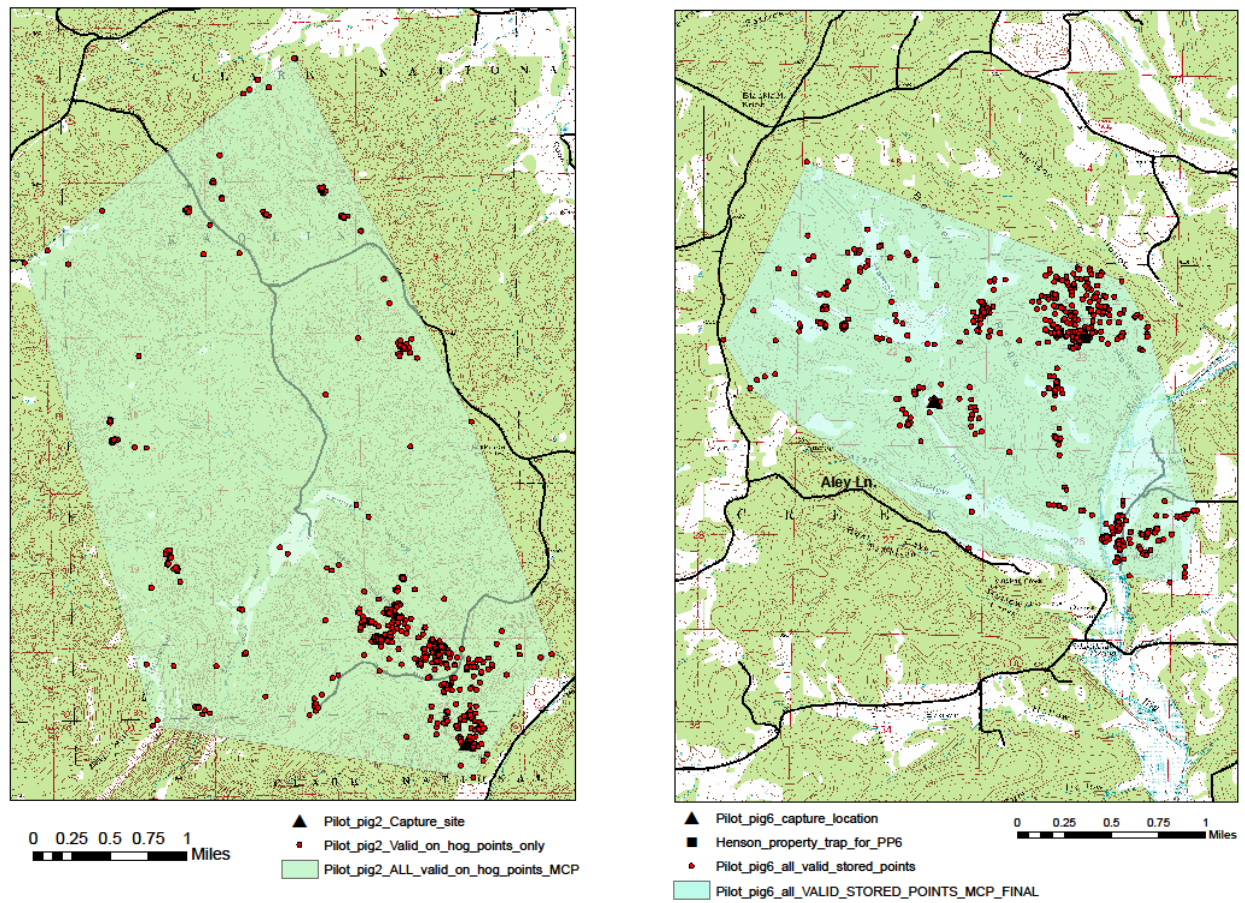


Figure 2. Maps of GPS points collected and minimum convex polygon home ranges of an adult male (left) and adult female hog (right).

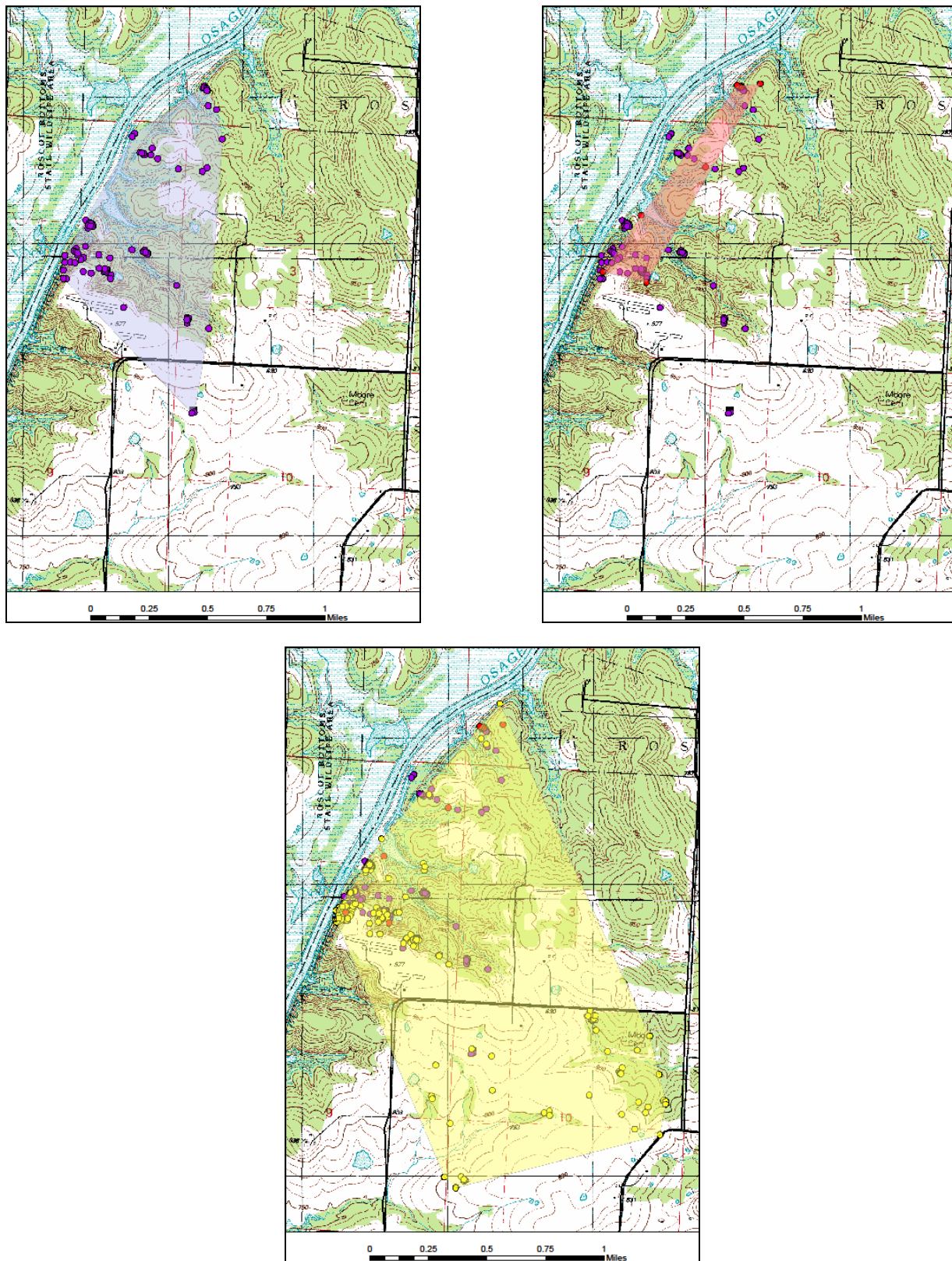


Figure 2. Points depicting movements before (top left, purple), during (top right, red), and after (bottom, yellow) aerial gunning.

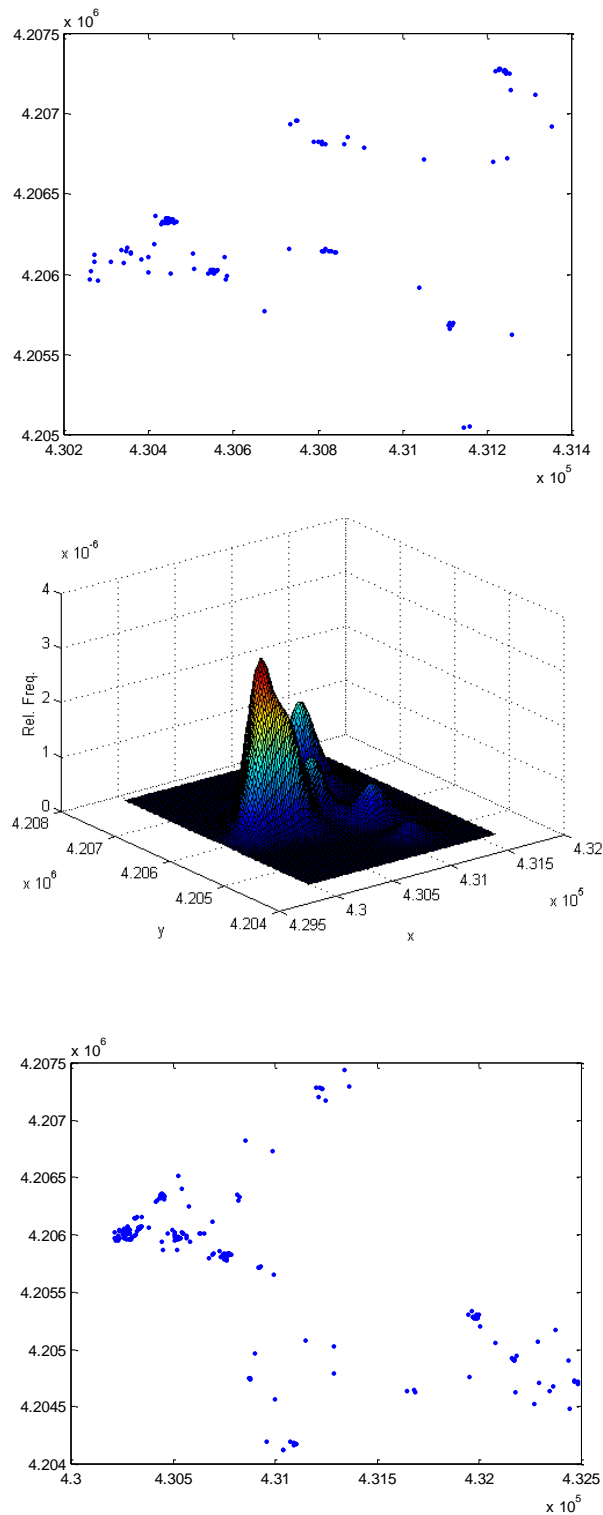


Figure 3. Graphical representation of movements of sub-adult female hog before (top) and after (bottom) aerial gunning.

Another important aspect of this project was to increase communication among field staff involved in feral hog control across the state. To achieve this, we created an incident command structure (Figure 4) and a website to facilitate communication. The website has been a valuable tool in sharing project information; so far, the website counter has recorded 131 visits. The website will become even more important in the coming months as we update everyone on the progress of putting collars out in the field.

### **FY11 Goals**

In FY11, we will continue to collect biological data and efficiency measures for our models. We will also be able, with our new GPS collars, to start monitoring hog responses to control measures. This will involve capturing a suitable candidate, monitoring her natural movements for a period of two months, and then implementing one of the control methods on her to see how she responds for an additional month. Tracking the hogs will require extensive field work, which will be carried out primarily by Nick RiViello, the temporary hourly employee hired through the Cooperative Agreement with MU. During the second year of this study, the main goal is to continue compiling data that will ultimately be used to make a decision on what will be done about hogs in Missouri.



## LARGE CARNIVORE INVENTORY

### **LARGE CARNIVORE INVENTORY AND MARKING STUDY: 2010 UPDATE**

Dan Dobesh, Resource Assistant, Missouri Department of Conservation

#### **Background**

Dangerous captive animals have recently come under public scrutiny. Because of the inherent danger and potential liability associated with the possession of large carnivores, an effective system was needed to verify ownership and better monitor the legitimate purchase, sale, and trade of these animals. The Department of Agriculture is currently evaluating regulations for the possession of dangerous carnivores other than those regulated by MDC. The MDC has taken a proactive approach in response to the public demand for more accountability and to provide some consistency between us and the Department of Agriculture. The intent of these new provisions is to better enable our enforcement and record keeping obligations, safeguard permit holders from false claims of ownership, and satisfy public demand for higher accountability of owners of these potentially dangerous animals. In addition, our Department would have the ability to distinguish captive animals from truly wild animals.

Based on these issues, MDC recently made significant regulation changes pertaining to large carnivores owned under the Class II Wildlife Breeder Permit. The proposal to permanently mark all captive bears, mountain lions, wolves, and wolf hybrids was approved by the Regulations Committee and Conservation Commission in 2007. The regulation amendment (3 CSR 10-9.353 Privileges of Class I and Class II Wildlife Breeders) became effective March 1, 2008 and had a 1 July 2008 compliance date. Effective July 1, 2008, all mountain lions, black bears, wolves, and wolf-hybrids held under the privileges of a Class II Wildlife Breeder Permit were required to be uniquely identified with a permanent Passive Integrated Transponder (PIT) microchip. These microchips are about the size of a grain of rice and contain an electromagnetic code that can be used to identify animals. They can be injected under the skin to permanently mark animals without altering external appearance. Microchips are normally placed just under the skin along the back of the animal, between the shoulder blades. This standardized protocol allows animals to be searched quickly and efficiently. The regulation also requires owners to allow the Department to obtain, from each animal, a small blood or tissue sample sufficient for DNA analyses.



Captive mountain lion.

## Progress to Date

Surveys and interviews were completed for 33 of the then 50 captive carnivore owners in the state. Feedback from the interviews showed that a majority of owners are generally supportive of the new regulations, but have concerns about the welfare of their animals. An informational workshop was held in Jefferson City on February 9, 2008. The workshop provided a forum for MDC personnel, veterinarians, and captive carnivore owners to discuss the procedures for marking captive animals. The contract with Wildlife Genetics International for DNA testing was finalized in May 2008, renewed in April 2009, and again in April 2010. DNA samples will be stored by Resource Science Division in Columbia until all samples have been collected and then will be sent to Wildlife Genetics International for analyses. On April 22, 2010, nine more samples were sent to Wildlife Genetics International for DNA analyses.



Veterinarian inserts microchip into captive mountain lion.

Department personnel have assisted in implanting microchips in and collecting DNA samples from 131 different animals at 40 out of 41 facilities around the state. The one remaining owner that has not yet tagged their animals is officially out-of-compliance with the new regulation and those cases have been turned over to Protection Division. Attempts to contact the one non-compliant owner will continue until all of their permitted animals have been marked.

All permits to hold large carnivores expire June 30th of each year. The newest permit was issued January 26, 2010 for a wolf to be held in Lawrence County. Renewal letters and applications were sent to all current permit holders in April and May 2010. If the permits are not renewed by their expiration date, the permit holder is considered to be in violation of Missouri state code. Permit holders in violation may receive a citation from their local conservation agent if they wish to continue to hold large carnivores.



Anesthetized black bear.



## MOUNTAIN LION RESPONSE TEAM

### MOUNTAIN LION RESPONSE TEAM

Jeff Beringer, Resource Scientist, Missouri Department of Conservation

The Missouri Department of Conservation developed a Mountain Lion Response Team (MLRT) in 1996 to address the concerns and reports from the public of mountain lions and the occasional confirmed occurrence of a mountain lion in the state. The MLRT consists of 12 employees across the state. MLRT members have special qualifications or have received training to address mountain lion concerns and conduct investigations when evidence is present.

Mountain lion sightings are categorized and entered into a long-term database. We also keep track of confirmed cases of mountain lions in Missouri when there is hard physical evidence to support a sighting, such as a track, carcass, photo, video, etc. We have over 1,500 sightings in the database since 1994. We have been able to confirm the presence of 10 mountain lions in the state (Table 1, Figure 1).

During this past fiscal year we recorded over 160 reports of mountain lions in the state. This is a minimum number because many reports to local agency staff are not recorded. Most reports we receive are the result of our website reporting form and email account. We confirmed no mountain lion sightings this past year. We did conduct a number of field investigations, but in all instances track sign, photo analysis, and/or DNA evidence indicated other animals were mistaken for mountain lions.

Table 1. Confirmed Instances of Mountain Lions in Missouri

2006 – December Livingston County	Photo of probable sub-adult disperser taken by motion-activated game camera.
2006 – November Shannon County	Deer carcass characteristic of mountain lion kill with tracks found nearby.
2003 – August Callaway Co.	Approximately 1½-year-old male road kill. No obvious signs of confinement. Stomach contained remains of squirrel, rabbit and white-tailed deer. DNA analysis indicated North American heredity.
2002 – October Clay County	Two-to-three-year-old male road kill. No obvious signs of confinement. Intestines contained deer and raccoon hairs. DNA analysis indicated North American heredity.
2001 – December Pulaski County	Photo of probable sub-adult disperser taken by motion-activated game camera.
2000 – December Lewis County	Video by deer hunter in a tree stand.
1999 – January Texas County	Animal treed by rabbit hunters' dogs. Tracks in snow, and two deer carcasses characteristic of mountain lion kills found nearby.
1997 – January Christian County	Video by property owner (obtained through Dr. Lynn Robbins at Missouri State University in Springfield). Animal's behavior suggested possible former captive.
1996 – November Reynolds County	Night-time video by Conservation Agent of cat on deer carcass.
1994 – December Carter County	Small adult female treed and shot by two raccoon hunters near Peck Ranch Conservation Area. Carcass not recovered, but obtained photo of animal on truck tailgate. Each hunter fined \$2,000. November 1998, deer hunter found skinned pelt of a small adult female with head and feet attached. Pelt showed signs of freezer burn, and x-ray of skull revealed bullet fragments. Likely the same animal shot in 1994, but this cannot be confirmed absolutely.



Figure 1. Confirmed locations and information for mountain lions in Missouri from 1994-2010.



## COUGAR FIELD WORKSHOP

### FOURTH COUGAR FIELD WORKSHOP

Jeff Beringer, Resource Scientist, Missouri Department of Conservation

As the range of cougars expands eastward, it has become increasingly important that wildlife biologists are trained to reliably identify cougar sign and credibly interact with the media and public about cougars in eastern states. The Missouri Department of Conservation has been an active participant and co-sponsor of the Cougar Field Workshop since its inception in 2007. Workshop goals are to instruct biologists about cougar biology, sign, and how to deal with the public and media when real or perceived cougars are observed or reported by the public.

The workshop occurred March 8-12, 2010 at the Ladder Ranch in New Mexico. Attendees included representatives from the U.S. Fish and Wildlife Service (Maine Office); Missouri Department of Conservation; North Dakota Game and Fish Department; Louisiana Department of Wildlife and Fisheries; Maine Department of Inland Fisheries and Wildlife; Oklahoma Department of Wildlife Conservation; Keeping Track, Inc.; and Balanced Ecology, Inc. Missouri Department of Conservation staff presented information on their agency's policies which are in place to minimize stress on the public and wildlife management agencies when dealing with the inevitable controversies surrounding the cougar's unpredictable eastward march. Among Missouri's proactive management directives are their Mountain Lion Response Team and the current tagging and DNA registry database of captive large carnivores. The database of captive large carnivores allows Missouri wildlife managers to quickly eliminate reports of a "wild" cougar if testing shows alleged "wild" animals prove to be a match within their database of documented captive animals.



Figure 1. Rex Martensen describes kill characteristics to biologists from Texas and Australia.



Figure 2. Workshop Participants: Front row – Maria Davidson, Dr. Travis Perry, Harley Shaw. Middle row – Jason Dickey, Ginny Fifield, Mark McCullough, Keel Kemper, Stephanie Tucker. Back row – Rex Martensen, Jeff Beringer, Erik Bartholomew, Sue Morse, Orie Gilad, Mike Griffiths and Rick Winslow.